INDEX
OF
PHYSIOLOGY.

FAUGHT.

AN

INDEX OF PHYSIOLOGY,

BY

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TO

ALBERT H. SMITH, M. D.,

IN APPRECIATION OF HIS HIGH PROFESSIONAL CHARACTER,
AND IN ACKNOWLEDGMENT OF HIS MANY ACTS
OF PERSONAL KINDNESS,

THIS BOOK

IS AFFECTIONATELY DEDICATED.

PREFACE.

THE INDEX OF PHYSIOLOGY makes no pretension as a contribution to original investigation; but has been compiled with the view of giving to the advanced student, a ready and complete reference book of physiological facts; and to the novice, a clear foundation for more mature study.

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CONTENTS.

AN INDEX OF PHYSIOLOGY.

DEFINITION OF PHYSIOLOGY.—Physiology is the science of life. Life is the sum of the functions. FUNCTIONS.—A function is that which an organ does. There are three kinds of functions; nutritive, animal or of relation, and reproductive. The nutritive NUTRITIVE FUNCTIONS.—functions are digestion, absorption, circulation, respiration, nutrition, calorification and secretion. The animal functions are ANIMAL FUNCTIONS.—sensation, mental and moral manifestations, muscular motion, and expression REPRODUCTIVE FUNCTION.—or language. Generation is the reproductive function.

VITAL PHENOMENA.—Vital phenomena are simple physical phenomena, acting under peculiar conditions and circumstances.

THE CELL.—The smallest particle of matter in any organism is a cell, it being the elementary unit.

THE GLOBULE.—The term CELL is applied to vegetable formations, GLOBULE, to animal ones. Three ORGANISMS.—kinds of matter compose all organisms :—bioplasm, formed material and pabulum. Bio- BIOPLASM.—plasm is germinal matter, or matter that FORMED MATERIAL.—is living; formed material PABULUM.—is matter that was living; and pabulum is matter about to become living. A cell is composed COMPOSITION OF A CELL.—of a wall filled with protoplasm, containing nuclei and nucleoli. It is spher- FORM.—ical in form, homogeneous and compact, with water as its dominant element,—constituting by weight nearly four-fifths of each. A peculiar property of cells, is their tenacity of composition in spite of sur- BIRTH.—rounding elements. Each cell is born of another, in a fluid known as blastema. The division of a SEGMENTATION.—parent cell into two, four, or a multiple, is called segmentation; and when after segmentation, the cells still remain within the wall of the ENDOGENESIS.—parent cell, the term endogenesis is applied. There are four kinds of cells :—epithelial, KINDS OF CELLS.—nerve, blood and embryonic.

THE CONDITIONS OF LIFE.—For the maintenance of life, three chemical conditions are required;

a supply of air, water and combustible material. The AVERAGE WEIGHT OF MAN.—average weight of man is one hundred and forty pounds. The heat HEAT OF THE BODY.—of the body arises from combustion.

THE KINGDOMS OF NATURE.—The kingdoms of nature are the organic and the inorganic,—the former including vegetables and animals,—the latter, minerals and gases. They differ in origin, DIFFERENCE BETWEEN THE ORGANIC AND THE INORGANIC.—shape, size, chemical composition and growth; these being for the most part definite in the organic, but indefinite in the inorganic; while growth occurs in the inorganic by accretion, but in the organic, from within. The marked distinction DIFFERENCE BETWEEN VEGETABLES AND ANIMALS.—between vegetables and animals is that the latter possess the power of sensation and voluntary motion, which the former do not. To test for origin, burn the substance, and the presence or absence of an unmistakable animal odor will determine the kind.

CLASSIFICATION OF NATURE.

KINGDOMS.

MINERAL. VEGETABLE. ANIMAL.

ARCHETYPES.

VERTEBRATA. ARTICULATA. MOLLUSCA. RADIATA.
PROTOZOA.

CLASSES.

PISCES. REPTILIA. AMPHIBIA. AVES. MAMMALIA.

ORDERS.

SUB-CLASSES.		
1. VIVIPARA, or PLACENTALIA.	UNGUICULATA.	BIMANA. QUADRUMANA. CHEIROPTERA. INSECTIVORA. CARNIVORA. CETACEA. RODENTIA. EDENTATA.
	UNGULATA.	PACHYDERMATA. RUMINANTIA.
2. OVOVIVIPARA, or IMPLACENTALIA.		MARSUPIATA. MONOTREMATA.

FAMILIES.
GENERA.
SPECIES.

ARCHETYPES.—Animals are classified into archetypes, from some particular plan of structure, observable in them. The archetype vertebrata, (latin, *ver-*
VERTEBRATA.—*tere*, to turn,) includes animals possessing a vertebral column. An example is man.
ARTICULATA.—Animals formed of segments are called articulata, (latin, *articulus*, a joint.) An ex-
MOLLUSCA.—ample is the lobster. The peculiar characteristic of the mollusca is softness, (latin, *mollis*, soft.) An example is the oyster. Animals radiating
RADIATA.—from a centre are called radiata, (latin, *radius*, a rod.) An example, the star-fish. The
PROTOZOA.—archetype protozoa, (greek, *protos*, first; and *zoon*, an animal,) includes microscopical animals, found especially in water.

CLASSES.—The classes are based upon some special action or function peculiar to each. The
PISCES.—class pisces, includes the fishes, and is peculiar by living in water. Creeping animals, ser-
REPTILIA.—pents, lizards, the tortoise, etc., are included under the head of reptilia, (latin, *repto*, I
AMPHIBIA.—creep.) The class amphibia, (greek, *amphi*, both; and *bios*, life,) includes animals like the frog, living in two elements. The class aves, includes

AVES.—animals which fly, and possess horny bills. Example, birds. The class mammalia (latin, *mamma*, MAMMALIA.—a breast,) includes animals possessing mammary glands to suckle their young. Animals VIVIPARA.—bringing forth their young in a mature state, are termed vivipara, (latin, *vivus*, alive; and *pario*, I bring forth.) The sub-class ovovivipara, OVOVIVIPARA.—(latin, *ovum*, an egg; *vivus*, alive; and *pario*, I bring forth,) includes animals which bring forth their young in an immature state.

ORDERS.—The division into orders, is based upon well marked peculiarities of structure. Animals pos- PLACENTALIA.—sessing a placenta, are called pla- IMPLACENTALIA.—centalia; those which do not, implacentalia. The sub-class unguiculata, (latin, *un-* UNGUICULATA.—*guis*, a nail,) includes animals having nails or claws. The sub-class ungulata, (latin, UNGULATA.—*ungula*, a hoof,) includes animals with hoofs. The order bimana, (latin, *bis*, twice; BIMANA.—and *manus*, a hand,) includes animals having two hands, and the opposible thumb. Man only. The order quadrumana, (latin, *quatuor*, four; and QUADRUMANA.—*manus*, a hand,) includes animals having four hands. Monkeys, etc. The order

CHEIROPTERA.—cheiroptera, (greek, *cheir*, a hand; and *pteron*, a wing,) possess winged hands, like
INSECTIVORA.—the bat. The order insectivora, (latin, *insectus*, an insect; and *voro*, I devour,) includes animals feeding upon insects, as the mole and hedge-
CARNIVORA.—hog. The order carnivora, (latin, *carnis*, flesh; and *voro*, I devour,) includes animals which live upon flesh, as the lion. The order
CETACEA.—cetacea, (latin, *cetus*, a whale,) includes
RODENTIA.—all animals like the whale. The order rodentia, (latin, *rodo*, I gnaw,) includes animals which
EDENTATA.—gnaw, as the rat. Animals without teeth are called edentata, (latin, *e*, without; and *dens*, a tooth.) An example is the armadillo. The hard
PACHYDERMATA.—skinned animals, as the horse, elephant, etc., are called pachydermata, (greek, *pacchus*, thick; and *derma*, a skin.) The order
RUMINANTIA.—ruminantia, (latin, *rumino*, I chew the cud,) includes animals having a compound stomach; and no front teeth in the upper jaw, if an exception is made of the camel. The females of the
MARSUPIATA.—order marsupiata, (latin, *marsupium*, a pouch,) have a pouch for the reception of their young on birth. Examples, the kangaroo and opos-

sum. The order monotremata (greek, *monos*, one; MONOTREMATA.—and *trema*, a hole,) includes animals having a common outlet for the generative and excremental products, as the ornithorynchus.

FAMILIES.—The distinction of families, is founded upon some modification of form or structure. The GENERA.—division into genera, is based upon some difference in the number of teeth and claws. The SPECIES.—division into species, is based upon some difference in color, proportion and size.

PROXIMATE PRINCIPLES.

DEFINITION OF A PROXIMATE PRINCIPLE.—A proximate principle is any substance, simple or compound, which exists under its own form, in an animal solid or fluid; and which can be extracted by means that will not destroy its properties.

PROTINACEOUS COMPOUNDS.—The protinaceous compounds are:—Protiene, N.C.H.O.; albumen, N.C.H.O.P.S.; fibrine, N.C.H.O.P.S.; and caseine, N.C.H.O.S.

HYDRO-CARBONACEOUS PROXIMATE PRINCIPLES.—The hydro-carbonaceous proximate principles are:—Starch, glycogen, sugar, glucose, lactose, saccharose, fats, stearine, palmatine, oleine and cholesterine.

ALBUMINOUS MATTERS.—The albuminous

matters are:—Fibrine, albumen, albuminose, caseine, ptyaline, pepsine, pancreatine, mucosine, myosine, collagen, chondrine, gelatine, elastacine, keratine, cartilagine.

COLORING MATTERS.—The coloring matters are:—Haemaglobine, melanine, biliverdine, urochrome, luteine, chlorophylle and bilirubine.

CRYSTALLIZABLE NITROGENOUS MATTERS.—The crystallizable nitrogenous matters are:—Lecathine, cerebrine, leucine, sodium glycholate, sodium taurocholate, creatine, creatinine, urea, sodium urate and sodium hippurate.

STARCH.—Starch is found in various forms in the body. Glycogen is a sugar forming substance;—an
GLYCOGEN.—animal starch capable of being changed
SUGAR.—into glucose. Sugar exists in the body in
GLUCOSE.—various forms. Glucose is grape sugar,
DEXTROSE.—and is found in the liver. Dextrose is a form of grape sugar found in the liver, and in veins
LACTOSE.—leaving that organ. Lactose is found
FATS.—in milk. Fats are soluble in ether, but in-
OLEINE.—soluble in water. Oleine is a fluid fat. Margarine is a supposed mixture of stearine and palma-
STEARINE.—tine. It is a solid fat. Stearine is a

PALMATINE.—solid fat. Palmatine is a solid crys-
CHOLESTERINE.—tallizable fat. Cholesterine is found in the bile and brain.

FIBRINE.—Fibrine is found in the blood, chyle, and lymph. Albumen is found in the white substance
ALBUMEN.—of eggs, in the brain, in nerves, and in the blood. It is soluble in water. Vegetable albumen exists in turnips, asparagus, etc. Albuminose is found
ALBUMINOSE.—in the body, being formed during the process of digestion from albuminoid articles.
CASEINE.—Caseine is found in milk, and does not coagulate by heat. Ptyaline or salavin, is an album-
PTYALINE.—inoid substance found in the saliva. It
PEPSINE.—converts starch into dextrine. Pepsine is the active principle of the gastric juice. Pancreatine
PANCREATINE.—is found in the pancreatic juice,
MUCOSINE.—and seems to emulsify fats. Mucosine
MYOSINE.—is found in mucus. Myosine is found coagulated after death, in the contractile substance of
COLLAGEN.—striped muscular tissue. Collagen is found in bones, ligaments, etc. Chondrine is a form of
CHONDRINE.—gelatine, obtained from bones by
GELATINE.—boiling under pressure. Gelatine is found in tendons and ligaments. Elastacine is found in

ELASTACINE.—all elastic issues. Keratine is found
KERATINE.—in hair, nails and epidermis. Cartila-
CARTILAGINE.—gine is found in cartilage. Haem-
HAEMAGLOBINE.—aglobine is the coloring matter
MELANINE.—of the blood. Melanine is a black
BILIVERDINE.—coloring matter. Biliverdine is the green coloring matter of the bile. Urochrome is the
UROCHROME.—amber coloring matter of the
LUTEINE.—urine. Luteine is the yellow coloring found in the yolk of eggs, and in the corpus luteum.
CHLOROPHYLLE.—Chlorophylle is the green coloring matter in plants and leaves. Bilirubine is the
BILIRUBINE.—orange coloring matter in the bile.

LECITHINE.—Lecithine is found in the brain,
CEREBRINE.—spinal cord and nerves. Cerebrine
LEUCINE.—is found in the brain. Leucine is found in the spleen, pancreas and pancreatic juice. Sodium
SODIUM GLYCHOLATE.—glycholate is found in
SODIUM TAUROCHOLATE.—the bile. Sodium taurocholate is a peculiar ingredient of the bile. Crea-
CREATINE.—tine is found in the juice of muscle and
CREATININE.—in the blood. Creatinine is found
UREA.—in the juice of muscle and in the blood. Urea is found in urine. It crystallizes in four-sided prisms, is

soluble in water, and neutral in reaction to test paper.

SODIUM URATE.—Sodium urate is found in urine.

SODIUM HIPPURATE.—Sodium hippurate is found in urine, and is so-called because it was first obtained from that of the horse.

TISSUES.

PHYSICAL PROPERTIES OF TISSUES.—The physical properties of tissues are :—Elasticity, extensibility, porosity, endosmose and exosmose. By elasticity ELASTICITY.—is meant the capability of being drawn out, with the power of resuming the original shape. By EXTENSIBILITY.—extensibility is meant the possession of the power of being drawn out or lengthened. POROSITY.—By porosity is meant the possession of pores, or resembling a sponge. By endosmose is meant ENDOSMOSE.—the power a liquid has to pass from without a membrane, to the inside. By exosmose is EXOSMOSE.—meant the power a liquid has to pass from within a membrane to the outside.

VITAL PROPERTIES OF TISSUES.—The vital properties of tissues are :—Contractility, nervous force, common sensation and special sensation. Contractility CONTRACTILITY.—is the power which a tissue has

of shortening upon itself. Nervous force is that NERVOUS FORCE.—property possessed by nerves, of being called into action by an appropriate stimulus.

COMMON SENSATION.—Common sensation is that recognition of impressions by nervous tissue, which is general to the body. Special sensation is that SPECIAL SENSATION.—recognition of impressions by nervous tissue, which is special to a part or organ, and possessed by no other.

KINDS OF TISSUE.—The kinds of tissue found in the body are :—Connective tissue, areolar tissue, fibrous tissue, elastic tissue, adipose tissue, cartilaginous tissue, osseous tissue, muscular tissue, nervous tissue, membraneous tissue, and epidermic tissue. The MODIFICATIONS OF TISSUE.—modifications of tissue are :—The hair, nails, teeth, the humors and other portions of the eye.

ALIMENTATION.

APPETITE.—Appetite is the pleasant desire for
HUNGER.—food; while hunger is the painful desire for food. Thirst is a general expression of the entire system for drink, and is located apparently in the tongue and fauces.

AQUEOUS FOOD.—Aqueous food, (H. O.) includes water or water holding important elements in solution. The saccharineous articles of food (C.H.O.)
SACCHARINEOUS FOOD.—are:—Sugar, starch,
OLEAGINOUS FOOD.—gums and vinegar. Oleaginous food includes oils, fats and alcohol. The albu-
ALBUMINOUS FOOD.—minous articles of food are:—Albumen, fibrine, caseine, and vegetable gluten.
DIVISION OF FOOD.—Food is divided into nitrogenous and non-nitrogenous. Nitrogenous food is nu-
NITROGENOUS FOOD.—tritive or histeogenetic.
NON-NITROGENOUS FOOD.—Non-nitrogenous food is calorifacient or heat producing.

DIGESTION.

DIGESTION.—Digestion is the process by which food is prepared for absorption; the first stage is PREHENSION.—prehension and consists in taking food and placing it in the mouth, by organs which act for this purpose, namely,—the bill in birds; the hands in man; the trunk in the elephant; the lips and teeth ORGANS OF PREHENSION.—in ruminants; and the claws and teeth in carnivorous animals. The mouth THE MOUTH.—is a cavity lined by mucous membrane, and bounded above by the hard palate; on LINING.—each side by the cheek; anteriorly, by the lips; on the bottom by muscular structure; and posteriorly by the pharynx, separated by the velum. In it are situated the organs of the second stage of diges- ORGANS OF MASTICATION.—tion,—mastication, which are divided into the active and passive.

PASSIVE ORGANS OF MASTICATION.—The

passive organs are: the masticatory bones, the liga-
ments and the teeth. The masticatory bones are the
MASTICATORY BONES.—superior and inferior max-
illæ, or upper and lower jaw bones; and the palate
bones. The superior maxillary bones are two in num-
SUPERIOR AND INFERIOR MAXILLARY
BONES.—ber; while the inferior maxillary bones, ex-
isting as two in the fœtus, become united later in life,
and appear as one in the adult. The palate bones are
THE PALATE BONES.—two in number, and are
situated back of the superior maxillary. Articulated
GOMPHOSIS.—with the jaws by the alveolar process,
THE TEETH.—constituting gomphosis, are the teeth;
the hard organs of mastication, situated in the aliment-
ary canal, anterior to the pylorus. They do not belong
RELATION.—to the skeleton, but to the digestive tract,
and each is anatomically divided into a crown, neck
THE CROWN.—and root. The crown is that portion
above the gums; the root, that portion below them;
THE ROOT AND NECK.—and the neck, the con-
stricted portion between the crown and the root. There
SETS OF TEETH.—are two sets of teeth,—the tempo-
rary and the permanent. In the former there are
TEMPORARY.—twenty teeth,—ten in each jaw; while in

PERMANENT.—the latter there are thirty-two,—sixteen
TYPICAL FORM OF A TOOTH.—in each jaw. The typical form of a tooth is a cone. The incisor teeth
INCISOR TEETH.—are the four in each jaw, occupy-
SHAPE.—ing the anterior portion of the arch. They are
LABIAL SURFACE.—wedge-shaped, and present a labial
PALATINE SURFACE.—surface, toward the lips; a pala-
CUTTING EDGE.—tine surface toward the palate; a cutting edge, formed by the union of the palatine and labial surfaces; a mesial surface, toward the
MESIAL SURFACE.—central line of the mouth, forming with the cutting edge nearly a right angle; and
DISTAL SURFACE.—a distal surface, looking away from the central line of the mouth, and rounded in its union with the cutting edge. These teeth are divided into centrals and laterals; the upper centrals
SIZE.—being larger than the upper laterals, while the lower centrals are smaller than the lower laterals. The incisor teeth have a single root, conical in shape.
ROOTS.—The root of the laterals is more flattened than that of the centrals. The cuspid teeth, are situ-
THE CUSPIDS.—ated next to the incisors, and pre-
ROOT.—sent a single crown, with a single root, which is the longest in the head. The bicuspid teeth are

THE BICUSPID TEETH.—four in each jaw, and ANTERIOR SURFACE.—present an anterior surface, as the one nearest the median line; a posterior surface, POSTERIOR SURFACE.—toward the back of the mouth; BUCCAL SURFACE.—a buccal surface, toward the cheek; LINGUAL SURFACE.—and a lingual surface, toward the tongue. They have, as a rule, a single root, with ROOTS.—a tendency to become double, and superior first bicuspids often have two roots. The molar teeth THE MOLAR TEETH.—are six in each jaw, and present four or five cusps, having in the lower mouth usually two roots, and in the upper, three. The teeth are so articulated with one another, that each tooth ORAL TEETH.—has two antagonists. The canines and incisors are called the oral teeth. All the POSITION OF ROOTS.—roots of the teeth look away from the median line of the mouth.

TOOTH GERMS.—In the development of the teeth, tooth germs are never found upon the surface, and every known tooth germ consists, at first, of two portions;—the enamel germ and the dentine germ. ENAMEL GERM.—The former comes from the DENTINE GERM.—mucous membrane of the mouth; and the latter, from the sub-mucous tissue. The

earliest change that will result in the formation of a DEVELOPMENT OF THE TEETH.—tooth is observable about the fortieth day of uterine life, and consists of a slight rounded depression of the mucous membrane of the mouth, which at a later period becomes enlarged and slightly indentated in the base. DENTINE PULP.—Rising into this indentation, is a portion of the sub-mucous tissue, the future dentine pulp. Around the sides of the dipping down, is columnar epithelium, and its central space, is filled ENAMEL PULP.—with stellate cells. This structure is known as the enamel pulp, and from it is formed the enamel of the tooth;—the columnar epithelium becoming converted into the enamel prisms. The DENTINE.—odontoblast cells of the dentine pulp are converted into dentine; while the free edges of this pulp extend up around the enamel organ, becom- TOOTH SAC.—ing known as the tooth sac, and ALVEOLO-DENTAL MEMBRANE.—subsequently, CEMENTUM.—the alveolo-dental membrane. From it is formed the cementum.

CALCIFICATION OF DENTINE.—The calcification of the dentine begins before that of the enamel, and is formed from without, inwards; the uncalcified

DENTINAL FIBRILS.—portion of the odontoblast cells, being the dentinal fibrils; and the portion of the DENTINAL PULP.—dentine pulp, uncalcified, being the dentinal pulp. The outer layer of odontoblast MEMBRANA EBORIS.—cells on the dentinal pulp constitutes the membrana eboris. The enamel is CALCIFICATION OF ENAMEL.—formed from within, outwards.

ERUPTION OF THE TEETH.—The teeth erupt in the following order, the lower generally preceding the upper by a few weeks:

DECIDUOUS SET.—

2	Central Incisors	erupt	between	5th	and	8th	mos.
2	Lateral	"	"	7th	"	10th	"
2	Canines	"	"	12th	"	16th	"
4	Molars	"	"	14th	"	36th	"

PERMANENT SET.—

2	Central Incisors	erupt	between	6th	and	8th	years.
2	Lateral	"	"	7th	"	9th	"
2	Canines	"	"	11th	"	12th	"
2	1st Bicuspids	"	"	9th	"	10th	"
2	2nd "	"	"	10th	"	11th	"
2	1st Molars	"	"	5th	"	6th	"
2	2nd "	"	"	12th	"	14th	"
2	3rd "	"	"	17th	"	25th	"

ABSORPTION OF THE ROOTS OF THE TEMPORARY TEETH.—The roots of the temporary teeth are absorbed by a retrograde metamorphosis.

ENAMEL.—The enamel is composed of hexagonal prisms, and is the hardest structure in the body, forming the crowns of the teeth. The dentine
DENTINE.—is softer than the enamel, and forms the body of the tooth, being a hard, elastic substance, of a yellowish tinge; its mass consisting of an organic
DENTINAL TUBULI.—matrix, in which are tubes, known as dentinal tubuli. The cementum covers
CEMENTUM.—the roots of the teeth, and is closely allied, in nature, to bone. It overlaps the enamel
NASMYTH'S MEMBRANE.—at the neck, and is supposed to cover, in a thin layer, the entire crown, forming Nasmyth's membrane. In the centre of every
PULP CAVITY.—tooth is the pulp cavity; and in it
PULP.—is the formative organ of the tooth,—the pulp.

ACTIVE ORGANS OF MASTICATION.—The active organs of mastication are:—the temporal, masseter, and pterygoid muscles. The temporal muscle is
TEMPORAL MUSCLE.—fan shaped, and arises
ORIGIN.—from the temporal bone, to be inserted

INSERTION.—into the coronoid process of the lower jaw. The masseter muscle lies directly under the MASSETER MUSCLE.—skin, on the side and back ORIGIN.—of the face; arising from the superior max- INSERTION.—illa, malar bone, and zygomatic process. ACTION.—It is inserted into the external side of the ramus, and into the angle of the lower jaw, acting to elevate the mandible. The external pterygoid muscle EXTERNAL PTERYGOID MUSCLE.—arises from ORIGIN.—the external plate of the pterygoid process INSERTION.—of the sphenoid bone; and is inserted into the inner side of the neck of the lower jaw. It ACTION.—acts to elevate and protrude the lower jaw, giving also lateral motion. The internal pterygoid INTERNAL PTERYGOID MUSCLE.—muscle arises ORIGIN.—from the inner surface of the pterygoid plate; INSERTION.—and is inserted into the inner face of the angle of the lower jaw. Its action is to elevate the ACTION.—lower jaw, and to give lateral motion.

THE TONGUE.—In the mouth is the tongue, a muscular organ, composed of two symmetrical halves, separated by a median fibrous septum. It is used for sucking, especially in the infant, where it is of the greatest importance. Its muscles are divided into the

MUSCLES.—extrinsic and the intrinsic. The extrinsic
EXTRINSIC MUSCLES.—muscles are :—the hyo-glossus, genio-hyo-glossus, stylo-glossus, and palato-glossus. The
INTRINSIC MUSCLES.—intrinsic muscles are the muscles proper of the tongue, viz. :—The superior longitudinal, inferior longitudinal or lingualis, and the transverse.

REGULATION OF MASTICATION.—The process of mastication, through which the food is comminuted, is regulated by the sensibility of the teeth to impressions of hard or soft substances.

INSALIVATION.—The third stage of digestion is called insalivation, and consists in the incorporation of saliva with the food. The salivary glands are race-
SALIVARY GLANDS.—mose, and are divided into three pairs;—the submaxillary, sublingual, and parotid.
PAROTID GLANDS.—The parotid glands are the
SITUATION.—largest, and are situated below and in
DUCTS.—front of the ears. They are emptied by the ducts of Steno. Their secretion is thin, watery,
PAROTID SALIVA.—limpid, colorless, inodorous,
SUBMAXILLARY GLANDS.—and tasteless. The submaxillary glands are the second in size, and are sit-
SITUATION.—uated in the sub-maxillary triangles of
DUCTS.—the neck. They are emptied by the ducts of

Wharton, which are about two inches in length, and open by the side of the frænum. The submaxillary
SUBMAXILLARY SALIVA.—secretion is colorless, limpid, inodorous, viscid, and glutinous. The sublingual glands are situated beneath the tongue, on
SUBLINGUAL GLANDS.—each side of the frænum,
DUCTS.— and are emptied by from eight to twenty
SUBLINGUAL SALIVA.—ducts. Their secretion is more viscid than the submaxillary saliva. The
SALIVA.—amount of saliva ordinarily secreted, is
SPECIFIC GRAVITY.—about three pounds daily, with a
REACTION.—specific gravity of 1004. In reaction, it is
FUNCTION.—constantly alkaline. The function of saliva is to soften hard articles of food, to coat the bolus with a glairy covering, facilitating its being swallowed; and possibly to entangle air, which in the stomach would hasten the penetration of the gastric juice.

DEGLUTITION.—The fourth stage of digestion is deglutition, and consists in swallowing the food; the passage of which through the isthmus of the fauces is voluntary; while its passage through the pharynx and œsophagus is involuntary. The tongue is the
THE TONGUE.— chief agent in the introduction of

THE PHARYNX.—the food into the pharynx,—an
LENGTH.—irregular, funnel-shaped cavity, about four
and a half inches in length, separated from the mouth
OPENINGS INTO THE PHARYNX.—by the velum
pendulum palati. The openings into the pharynx above
are;—the posterior nares, and the orifices of the eusta-
chian tubes; while below are the larynx, and œsophagus.
The posterior nares are protected during deglutition by
the soft palate; and the larynx, by the epiglottis.

THE MUSCLES OF THE PHARYNX.—The
muscles of the pharynx are,—the superior, middle,
and inferior constrictors, and the stylo-pharyngeus.
SUPERIOR CONSTRICTOR MUSCLE.—The su-
ORIGIN—perior constrictor muscle arises from the in-
ternal pterygoid plate of the sphenoid bone, and is
INSERTION.—inserted into the median raphe. The
STYLO-PHARYNGEUS MUSCLE.—stylo-pharyn-
ORIGIN.—geus muscle arises from the styloid process of
INSERTION.—the temporal bone; its fibres mingle with
the constrictors and palato-pharyngeus, and are inserted
MIDDLE CONSTRICTOR MUSCLE.—into the thy-
ORIGIN.—roid cartilage. The middle constrictor arises
from the hyoid bone and stylo-hyoid ligament, and is
INSERTION.—inserted into the median raphe. The

INFERIOR CONSTRICTOR MUSCLE.—inferior ORIGIN.—constrictor arises from the thyroid and cricoid INSERTION.—cartilages, and is inserted into the median raphe.

THE MUSCLES OF THE SOFT PALATE.—The muscles of the soft palate are:—the levator palati, tensor palati, palato-glossus, palato pharyngeus, and LEVATOR PALATI.—azygos uvulæ. The levator palati arises from the petrous portion of the temporal bone, and passes to be inserted into the soft palate. TENSOR PALATI.—The tensor palati arises from the scaphoid fossa of the sphenoid bone, winds around the hamular process, and is inserted into the soft palate. PALATO-GLOSSUS.—The palato-glossus arises from the side of the palate, and is inserted into the side and PALATO-PHARYNGEUS.—dorsum of the tongue. The palato-pharyngeus arises from the soft palate, and is inserted into the thyroid cartilage. The azygos AZYGOS UVULÆ.—uvulæ forms the fleshy portion of the uvula.

THE ŒSOPHAGUS.—The œsophagus is a muscular tube extending from the pharynx to the stomach. LENGTH.—It is about nine inches in length, and has a COATS.—muscular, an areolar, and a mucous coat.

STOMACH.—The stomach is the most dilated portion of the alimentary canal, and is from thirteen to
LENGTH.—fifteen inches in length, with a diameter in
DIAMETER.—its widest part of five inches. Its capacity
COATS.—is five pints. Its coats are three in number:
—the peritoneal, muscular, and mucous. The peri-
PERITONEAL COAT.—toneal coat is a reflection of the membrane lining the general abdominal cavity, and its function is to present a smooth surface, allowing the free movements of the organs over each other and over
MUSCULAR COAT.—the abdominal walls. The muscular coat is formed of involuntary fibres in two layers;
—an external, longitudinal, and an internal, circular one, with a few oblique fibres. The mucous lining is
MUCOUS COAT.—a continuation of the membrane in the œsophagus though different in appearance, being soft, velvety, and of a reddish gray color. It is covered by polygonal pits, with racemose glands opening into them; namely—the gastric and the mucous glands. The former or peptic glands, are found throughout the
PEPTIC GLANDS.—entire surface; while the latter
MUCOUS GLANDS.—exist principally near the pyloric extremity.

GASTRIC JUICE.—The gastric juice is secreted

only in obedience to the stimulus of food; and is a clear fluid of a faint, yellowish or amber tint, possessing little or no viscidity, with a specific gravity of
SPECIFIC GRAVITY.—1005. About fourteen pounds are
AMOUNT.—secreted in twenty-four hours. Pepsin or
PEPSIN.—gasterase is its organic principle, and also in
LACTIC ACID.—it is lactic acid. The gastric juice only prepares meats for their digestion in the intestine,
ACTION OF GASTRIC JUICE.—but acts readily upon albumen, fibrine, caseine, and gelatine; making
ALBUMINOSE.—a colorless fluid with a feeble odor, called albuminose, as the result of digestion. The
DURATION OF STOMACH DIGESTION.—average time that food remains in the stomach after an ordinary meal is from two to four hours. Regurgita-
REGURGITATION.—tion is the passage of food from the stomach to the mouth. Eructation is the
ERUCTATION.—escape of gases from the stomach through the œsophagus and mouth. Ruminant ani-
STOMACH OF RUMINANTS.—mals have four cavities in their stomach;—the paunch, the honeycomb, the many-plies, and the caulet.

SMALL INTESTINE.—The small intestine, so-called on account of its size, extends from the pyloric extrem-

ity of the stomach, to the ileo-caecal valve; being
MESENTERY.—held to the spinal column by a double
fold of serous membrane, called the mesentery. It
LENGTH.—is in length from fifteen to eighteen feet,
DIAMETER.—with a diameter of one and a quarter
DIVISIONS.—inches, and is divided into, the duodenum,
DUODENUM.—the jejunum, and the ileum. The
duodenum is so named from the fact that it is twelve fin-
COATS.—gers broad, or from eight to ten inches. It has
three coats;—a peritoneal, a muscular of involuntary
JEJUNUM.—fibres, and a mucous coat. The jeju-
num, or second division, includes the upper two-fifths
of the small intestine, deriving its name from the fact
ILEUM.—that it is found empty after death. The
lower three-fifths of the small intestine is named the
ileum. The lining mucous membrane is highly vascu-
MUCOUS MEMBRANE OF SMALL INTESTINE.
—lar, has a soft, velvety appearance, and presents,—
the valvulæ conniventes, the glands of Brunner, the
follicles of Leiberkuhn, the vili, and the patches of
VALVULÆ CONIVENTES.—Peyer. The valvulæ
conniventes are folds of the mucous membrane of the
small intestine, which serve to increase the mucous
surface aud possibly to retard the food in its passage.

GLANDS OF BRUNNER.—The glands of Brunner are found in the duodenum, but in no other part of the canal; they are racemose, and aid in the secretion of the enteric fluids. The follicles of Leiberkuhn, or FOLLICLES OF LEIBERKUHN.—intestinal tubules, are the most important glandular structures in the small intestine, being the chief agents in the production VILI.—of the intestinal juice. The vili are chiefly concerned in absorption, being situated throughout the entire small intestine, but not found beyond the ileo-cæcal valve. They are simple elevations of the mucous membrane, provided with bloodvessels and GLANDS OF PEYER.—lacteals. The patches of Peyer are found in the ileum opposite the attachment of the mesentery; they exist sometimes in the jejunum and duodenum, and are supposed to aid absorption. Solitary glands, resembling in nature the glands of Peyer, are found both in the large and small intestines.

INTESTINAL JUICE.—The flow of intestinal juice takes place normally only in response to the stimulus of food. It is viscid, colorless or of a rose tint, and in reaction, invariably alkaline. It readily ACTION.—converts starch into sugar, but acts only as a valuable adjunct to other intestinal fluids, rather

than as the digestive agent of any particular article of food.

PANCREAS.—The pancreas is a glandular organ situated in the upper posterior part of the abdom-
WEIGHT.—inal cavity. It weighs from four to five
SIZE.—ounces, and is in length, seven inches; in breadth, an inch and a half; and in thickness, three-quarters of an inch. It has been called the abdominal salivary gland, and is emptied by one or two ducts, into the duodenum. Its secretion is viscid,
PANCREATIC JUICE.—opaline, and has a distinct
SPECIFIC GRAVITY.—alkaline reaction, with a specific
ACTION.—gravity of 1040. This fluid exerts an important influence on nearly all articles of food, and especially upon fats, which it digests by effecting their minute subdivision, in the form of an emulsion. It also digests starch and nitrogenized principles.

THE BILE.—The bile has no marked influence upon any special class of food, but undoubtedly aids
COLOR.—the digestive process. It is of a brownish
SPECIFIC GRAVITY.—hue, and has a specific gravity of
REACTION.—1018, with an alkaline reaction. It is supposed to influence the peristaltic action of the intestine. The contractions of the muscular coat of the

MOVEMENTS OF THE INTESTINES.—small intestines, propel the food along the canal, by a motion called peristaltic.

LARGE INTESTINES.—The large intestine is so
DIAMETER.—called because it exceeds the rest of the
intestinal tract in its diameter, which is from two and
LENGTH.—a half to three and a half inches. It is from
CAECUM.—four to six feet in length. Its first divi-
RECTUM.—sion is known as the caecum, and the
COLON.—last as the rectum; the portion between these two is called the colon, being divided into an ascending, a descending, and a transverse colon, and
SIGMOID FLEXURE.—sigmoid flexure. At the
VERMIFORM APPENDIX.—lower portion of the caecum is a tube from one to five inches in length called the vermiform appendix Its use is unknown.
ILEO-CAECAL VALVE.—The valve closing the opening between the ileum and the caecum, is called the ileo-caecal valve. The large intestine is covered
PERITONEAL COAT.—generally by peritoneum, although it is absent in some portions. The middle
MUSCULAR COAT.—coat is muscular, the circular fibres of which at the anus form the sphincter ani.
MUCOUS COAT.—The mucous coat differs mark-

edly from that of the small intestine, as valvulæ conniventes do not exist in any part. The large intestine

CONTENTS OF LARGE INTESTINE.—contains principally residue matter, known as fæces; and has a

MOVEMENTS.—motion somewhat similar to that of the small intestine but far less vigorous. The expulsion of

DEFÆCATION.—fæcal matter, which generally takes place once a day, is called defæcation.

ABSORPTION.

ABSORPTION.—The process by which materials, and especially digested ones, are taken into the blood is called absorption. The vessels performing this function are the bloodvessels and lymphatics. The LYMPHATIC SYSTEM.—lymyhatic system is divided into a superficial and a deep layer; and its vessels present, in many parts of their course, little solid structures called lymphatic glands. The lacteals are essentially lymphatics, and when not filled with the products of digestion carry colorless lymph. The lymphatics, except the smallest, exhibit in their construction immense numbers of valves. A marked peculiarity of their structure is that they vary but little in size. They are unevenly distributed,—few in some portions of the economy, and large numbers in others. LACTEALS.—The lymphatics of the small intestine, the lacteals, pass from the intestine between the folds

of mesentery, and empty by from one to five trunks into the receptaculum chyli. The glands through

MESENTERIC GLANDS.—which the lacteals pass in this location are called mesenteric glands. The re-

RECEPTACULUM CHYLI.—ceptaculum chyli is an enlargement of the thoracic duct, the latter being

THORACIC DUCT.—about the size of a goose quill, and emptying its contents into the left sub-clavian vein. Numerous stomata or mouths exist in the walls of the lymphatic vessels.

LYMPHATIC GLANDS.—There are from six to seven hundred lymphatic glands in the body; and their function seems to be to retard the passage of the lymph toward the great trunks, thus aiding the arrest

SKIN.—of morbid matters. The skin exerts an absorbent power, especially upon water. Fats in a state

FATS.—of emulsion are absorbed by the lacteals, and possibly in small quantity by the bloodvessels. Imbi-

IMBIBITION.—bition is a property common to all animal structures, by which they are enabled to take up a certain portion of a fluid. Many of the phenomena of absorption, as endosmosis and exosmosis, are illustrations of the power of imbibition. Chyle is

CHYLE.—lymph plus the products of digestion, and

SPECIFIC GRAVITY.—has a specific gravity of 1024.

LYMPH.—Four pounds of lymph are produced in twenty-four hours. It is colorless or of a yellowish

SPECIFIC GRAVITY.—hue, has no odor, possesses a specific gravity of 1007, and contains corpuscular ele-

ORIGIN.—ments known as lymph corpuscles. There can scarcely be any doubt but that the lymph is derived

FUNCTION.—from the blood. The function of this material is to remove from the tissues the products of decay. The flow of the lymph and chyle over the route of the lymphatic circulation, is the result of the forces of endosmosis and transudation, more or less modified by other circumstances.

THE BLOOD.

THE BLOOD.—The blood is the most highly organized fluid in the body. All tissues are not supplied with bloodvessels, and those which are not are known as extra vascular tissues, being of low organization such as hair, cartilage, etc. In case of hæmorrhage all the blood does not escape from the body owing to the diminution of the heart's force. The amount of QUANTITY.—blood in the body is in the ratio of one to eight,—about sixteen to eighteen pounds. The OPACITY.—opacity of the blood depends upon the ODOR.—varying density of its constituents. Its odor TASTE.—is heavy; taste, saltish, due to chloride of REACTION.—sodium; the reaction, alkaline, due to basic carbonate and phosphate of soda; the specific SPECIFIC GRAVITY.—gravity 1052 to 1057; and the TEMPERATURE.—temperature from 98° to 100° Fah. COLOR.—The red color of the blood is due to the red

corpuscles, and is darker in the veins than in the arte-
CORPUSCLES.—ries. Besides the red corpuscles there are in the blood the white, although the red are by far the most abundant and constitute about one-half of the mass of the blood. The white corpuscles or leucocytes are in the proportion of 1 : 700 of the red. The corpuscles are flattened, biconcave, circular
RED.—discs and very elastic. The red have a spe-
SPECIFIC GRAVITY.—cific gravity of 1088 to 1105, and
DIAMETER.—a diameter of $\frac{1}{3500}$ of an inch. The
WHITE.—leucocytes are found not only in the blood, but also in lymph, chyle, pus, and other fluids. Their
SPECIFIC GRAVITY.—specific gravity is 1070, with a diam-
DIAMETER.—eter of $\frac{1}{2500}$ of an inch. The plasma of the
PLASMA.—blood is composed of water holding important organic and inorganic principles in solution. It is known as the liquor sanguinis and has a specific grav-
FUNCTION OF CORPUSCLES.—ity of 1028. The function of the red corpuscles is to carry the gases. The
COLORING MATTER OF RED CORPUSCLES.—coloring matter of the red corpuscles is hæmaglobine.
PLASMINE.—Plasmine is composed of fibrine and met-
ALBUMEN.—albumen. The albumen of the blood is formed by the union of serine and metalbumen.

COAGULATION.—The coagulation of the blood is due to the formation of fibrine, and in the process
CLOT.—the blood divides into a clot and serum. The clot or crassamentum is composed of corpuscles, red and white, and fibrine, also retaining about one-
BUFFY COAT.—fifth of the serum. The buffy coat of the clot is due to the white corpuscles. The se-
SERUM.—rum retains all the elements of the plasma except those of fibrine.

CIRCULATION OF THE BLOOD.

CIRCULATION OF THE BLOOD.—Harvey discovered the circulation of the blood in 1616; Michael Servetus the pulmonary circulation in 1553; and Malpighi, the capillary circulation in 1661.

THE HEART.—The heart is a pear-shaped organ
WEIGHT.—situated in the left thoracic cavity. It weighs in the female from eight to ten ounces, and
CAVITIES.—from ten to twelve ounces in the male. It has four cavities,—a right and left auricle, and a right
PERICARDIUM—.and left ventricle. It is enveloped in a fibrous sac called the pericardium. Its cavities
ENDOCARDIUM.—are lined by a smooth serous membrane called the endocardium. The right auricle
AURICULAR APPENDIX.—has an appendix, resembling the ear of a dog, known as the auricular appendix. The openings between the auricles and
AURICULO-VENTRICULAR OPENINGS.—the

ventricles are known as the auriculo-ventricular open-

AURICLES.—ings. The walls of the auricles are thinner than those of the ventricles, and are composed of muscular fibres in two layers,—the outer, being common to both, and the inner, proper to each. Although the walls are involuntary in their action, they are composed of striated fibres. The walls of the

VENTRICLES.—left ventricle are thicker than those of the right. The ventricles constitute the bulk of the heart, and the arrangement of their muscular fibres is similar to that in the auricles. The inner surface of

COLUMNÆ CARNÆ.—the ventricles is marked by peculiar fleshy ridges and papillae, called columnæ

CHORDÆ TENDINÆ.—carnæ, and passing from them to the auriculo-ventricular valves are tendinous cords, known as chordæ tendinæ. The roughened surfaces of the auricles are known as the muscular

TRICUSPID VALVES.—pectinati. The three leaflets closing the auriculo-ventricular opening on the right side are called the tricuspid valves. The valves

PULMONIC VALVES.—closing the pulmonary artery are the pulmonic, semilunar, or sigmoid valves.

MITRAL VALVE.—The mitral or bicuspid valve is composed of two leaflets, and closes the left auriculo-

AORTIC VALVES.—ventricular orifice. The valves closing the aorta are known as the aortic, semilunar, or sigmoid valves. The sinuses of Valsalva are three
SINUSES OF VALSALVA.—pouches which occur behind the semilunar valves at the aorta. The corpora
CORPUS ARANTIUS.—Arantia are little bodies found on the semilunar valves, aiding in their closure.

MOVEMENTS OF THE HEART.—The heart is twisted from left to right, in systole, and untwisted in diastole, becoming hardened at each systole. The dil-
DIASTOLE.—atation of the cavities of the heart is
SYSTOLE.—called diastole; their contraction, sys-
IMPULSE.—tole. The heart is not situated in direct contact with the walls of the thorax, but during systole is forcibly impressed against them constituting impulse.
FORCE OF THE HEART.—The force of the left auricle is fifty-one and a half pounds. There is a
REGURGITATION OF BLOOD.—slight regurgitation of blood through the tricuspid valve, but this is not permitted by the mitral. There are two sounds
SOUNDS OF THE HEART.—of the heart;—the long, dull sound, and the short, quick sound,—between them is an interval of silence. The first of these sounds is produced by the impulse, the closure of the

auriculo-ventricular valves, and the rush of the blood over the roughened walls of the heart cavities; the other, is due to the closure of the aortic and pulmonic

FREQUENCY.—semilunar valves. The heart in the adult male makes about seventy pulsations in a minute, and a few more in the female. The frequency of course is modified by age, digestion, posture, muscular exertion, temperature, respiration, etc.

ROUTE OF THE CIRCULATION IN THE HEART.—The blood is received from the vena cava ascendens and descendens into the right auricle; and is passed from the right auricle through the auriculo-ventricular opening, closed by the tricuspid valve, into the right ventricle; from the right ventricle it passes through the pulmonary artery, closed by the pulmonic valves, to the lungs; from there it is returned by the pulmonary veins to the left auricle; from the left auricle it passes through the auriculo-ventricular opening, closed by the mitral valve, into the left ventricle; from the left ventricle it passes through the aorta, closed by the aortic valves, to the system at large. The

CORONARY SYSTEM.—blood in the heart does not nourish it; but it receives its supply by the coronary arteries, and returns that blood by the coronary veins,

which taken together constitute the coronary system.

ARTERIES.—The branches of arteries, except the intercostal, are given off at an acute angle. Arteries
FUNCTION.—convey red or arterial blood from the
COATS.—heart, and have three coats;—an outer of white or inelastic fibrous tissue; a middle of yellow elastic tissue; and an internal, serous coat. Owing
ELASTICITY.—to their elasticity, the arteries are distended during systole. At each contraction of the
LOCOMOTION.—heart the arteries are lengthened, and many of them undergo some locomotion. The sensa-
PULSE.—tion felt at each beat of the heart by placing the finger over an exposed artery is called the pulse.

CAPILLARIES.—The capillaries are the tubes connecting the arteries and the veins; they have but a single coat, and in them takes place the interchange of gases.

VEINS.—The veins collect the blood from the arteries and convey it back to the heart as venous or
COATS.—dark blood. They have three coats. Through-
VALVES.—out the veins are valves, situated just below the points where smaller veins empty into the larger, thus presenting an obstacle to the passage of the blood in the wrong direction. The cause of the venous cir-

culation is the pressure of the blood from behind,—the vis a tergo: and also the suction power of the heart,—the vis a fronte. The general average of the

GENERAL RAPIDITY OF THE CIRCULATION.

—duration of the circuit of the blood through the entire system is twenty-three seconds. The vessels them-

VASA VASORUM.—selves are nourished by smaller ones known as the vasa vasorum.

RESPIRATION.

RESPIRATION.—Respiration consists in an interchange of gases, and is the process by which tissues and organs receive and appropriate oxygen. The essential conditions of respiration in animals are;—a current of air and a current of blood, separated by a thin membrane which will allow the passage of the gases. The anterior opening into the pharynx leads

LARYNX.—to the larynx, and is the commencement of the respiratory passages. The larynx is a cartilaginous box, and across its superior opening are the vocal chords,—four in number. The two superior are false, and the two inferior are true vocal chords, being concerned in the production of voice. The opening be-

RIMA GLOTTIDIS.—tween these chords is known as the rima glottidis. The epiglottis is the cartilage

EPIGLOTTIS.—that serves to close the larynx during deglutition. From the larynx to the lungs is a tube,

TRACHEA.—four and a half inches in length and three-quarters of an inch in diameter, known as the trachea. It is composed of from sixteen to twenty cartilaginous rings, which are cartilage in the anterior two-thirds;—the posterior one-third of each being fibrous tissue. In the chest the trachea divides into BRONCHI.—two bronchi, the right being the shortest and largest. The bronchi divide into bronchioli, and these end in the air cells. The lungs and air passages MUCOUS MEMBRANE.—are lined by mucous mem- PARENCHYMA.—brane. The tissue of the lungs is LUNGS.—known as their parenchyma. The lungs are irregular cones situated in the thoracic cavity. Arterial blood for their nourishment is conveyed to them by the bronchial arteries.

INSPIRATION.—Inspiration is the process by which air is taken into the lungs. The muscles used are those of the upper portion of the chest, together with the intercostals and diaphragm. Expiration is EXPIRATION.—the process by which air is forced out of the lungs, and is accomplished by the elasticity of the lungs and thoracic walls, aided by certain muscles which diminish the size of the chest. The fre- FREQUENCY OF RESPIRATION.—quency of

respiration varies with the time of life, being in the adult, one respiration to every four beats of the heart or from sixteen to eighteen in a minute. Snoring is a
SNORING.—peculiar sound caused by the flapping of the velum pendulum palati between two currents of air;—one from the mouth, and the other from the
RESIDUAL AIR.—nose. Residual air is that which cannot be expelled by a forced expiration, and is one hundred cubic inches. Reserve air is that which
RESERVE AIR.—remains after an ordinary expiration, but can be expelled by a forced one, and is one hundred cubic inches. Tidal or breathing air is that
TIDAL AIR.—which is changed by an ordinary inspiration and expiration, and is twenty cubic inches.
COMPLEMENTAL AIR.—Complemental air is the excess over the ordinary breathing air which may be drawn into the lungs by a forcible inspiration, and is one hundred and ten cubic inches. The extreme
BREATHING CAPACITY.—breathing capacity of the lungs is two hundred and thirty cubic inches. Some of the air inspired is lost in respiration.

COMPOSITION OF AIR.—Air is a mixture of oxygen and nitrogen in the proportion of one to four. The carbonic acid in respired air comes from the

venous blood, and a certain amount of vapor always accompanies it as a product of respiration. A small quantity of nitrogen is exhaled by the lungs. The CHANGES IN THE BLOOD IN RESPIRATION.—blood is changed from venous to arterial in its passage through the lungs. This is shown by a change in color from dark to bright red, and is caused by its giving off carbonic acid and taking up oxygen. Carbonic acid exists in solution in the plasma, while the other gases in the blood, and particularly oxygen, are in feeble combination with the coloring matter of the RESPIRATORY SENSE.—red corpuscles. Respiration takes place in response to a demand for oxygen on the part of the system known as the respiratory CUTANEOUS RESPIRATION.—sense. A certain amount of oxygen is absorbed by the skin, and a larger proportion of carbonic acid is exhaled. Asphyxia is death caused by cutting off the supply of oxygen to the system. It is the result of the fixation of the carbonic acid gas preventing the introduction of oxygen, and not due to any poisonous effects of that gas.

SECRETION.

SECRETION.—Secretion is intimately connected with nutrition and embraces the processes in which there is a separation of materials from the blood, or a formation of a new fluid out of matters furnished by it. Secretions are generally homogeneous fluids without formed anatomical elements, and are produced by ORGANS.—membranes, tubes, or glands. The structure SEROUS MEMBRANES.—of serous membranes is very simple;—they have a dense tissue of fibres covered by a single layer of pavement epithelium. They MUCOUS MEMBRANES.—line close cavities. Mucous membranes are attached by areolar tissue to the subjacent parts and are either covered by pavement or FUNCTION.—by columnar epithelium. They line open cavities. Mucus allows the parts moistened by it to move freely and modifies absorption. The cutaneous SEBACEOUS FLUIDS.—surface is lubricated by an

oily secretion called sebum, produced by sebaceous glands which are either simple or compound racemose.

CERUMINOUS GLANDS.—Ceruminous glands secrete a waxy matter, called cerumen, of a yellowish color and bitter taste. The mammary glands are re-

MAMMARY SECRETION.—markable organs in the economy, and have an areolar, or darker portion, encircling the nipple. All the important and characteristic materials in the milk are formed in the sub-

AMOUNT.—stance of the gland. About two or three pints of milk can be secreted by the average woman

SPECIFIC GRAVITY.—in a day. The specific gravity of milk is from 1032 to 1046. The first fluid drawn from

COLOSTRUM.—the breast after delivery is called colostrum and has a specific gravity above that of milk, being from 1046 to 1060.

EXCRETION.

EXCRETION.—Excretions are generally discharged from the body, and all their elements pre-exist in the blood either in the condition in which they are discharged, or in some slightly modified form.

THE SKIN.—The skin is an important structure of the body, and possesses a variety of functions;—EXTENT.—among them is excretion. The cutaneous surface of a good sized man is sixteen square feet. THICKNESS.—The skin varies in its thickness and exists usually in two layers,—the true skin, or cutis vera, derma, or corium; and the epidermis, cuticle, or scarf-skin. The epidermis serves as a protection to NAILS AND HAIR.—the more delicate true skin. The nails and hair are appendages of the epidermis.

NAILS.—The nails are situated on the dorsal surfaces of the distal phalanges of the fingers and toes, and serve to protect these parts. In prehension they

ROOT.—are quite important to the fingers. The root of the nail is thin and soft and is received in a fold
BODY.—of the skin. Its body extends from the fold of the skin to the free border, and is closely adherent
HAIRS.—by its under surface to the true skin. Hairs varying greatly in size and development cover every portion of the cutaneous surface except the palmar surfaces of the hands, feet, toes, and fingers; the lips; upper eyelids; and the lining of the prepuce and glans
VARIETIES.—penis. They are divided into short and stiff, long, fine and downy. The long and soft hairs are found on the head, the face of the adult male, around the genital organs, under the arms, upon the breast and over the general surface of the body of the male. The short and stiff are found in the nostrils, on the edges of the eyelids, and upon the eyebrows. The short, soft, downy hairs are found on all the general surface not occupied by the long hairs. The
ROOTS.—roots of the hair are imbedded in follicular
SHAFT.—openings in the skin. The shaft is composed of a medullary portion, covered by quadrangular scales, known as the epidermis of the hair or cortical portion. The medullary portion sometimes becomes filled with air giving rise to a change of color. Hairs

FUNCTION.—act as a protection to the surfaces upon which they are placed.

SUDORIPAROUS GLANDS.—The most numerous and most important glands of the skin are those secreting the sweat, and with few exceptions are everywhere placed upon its surface. The evaporation from the skin tends to regulate the temperature of the body, and about two pounds of sweat are thrown off in twenty-four hours, the specific gravity of which is 1003 to 1004. The action of the skin is vicarious with the kidneys.

URINE.—The urine is an excrementitious fluid eliminated by the kidneys, which are symmetrical organs, situated in the upper and posterior part of the

KIDNEYS.—abdomen. They are shaped like beans, with the central portion of the concave side, the hilum, looking toward the spinal column. Each

WEIGHT.—kidney weighs from four to six ounces, and the left is always a little heavier than the right. A

PELVIS.—section of the kidney shows a cavity at the hilum known as the pelvis. Each kidney is composed

CORTICAL SUBSTANCE.—of a cortical substance, and a pyramidal or medullary substance. The cortical is softer than the pyramidal substance. The medullary

MEDULLARY SUBSTANCE.—substance is arranged in the form of pyramids called the pyramids of Malpighi, and made up of tubes called the tubuli uriniferi. Attached to these tubes are convoluted ones, which pass to the Malpighian bodies situated in the cortical por- BLOODVESSELS.—tion of the kidney. The renal artery enters at the hilum, bringing blood to the kidney, which the renal veins remove.

PRODUCTION OF URINE.—Urea and other excrementitious constituents of the urine are produced by the process of disassimulation in the various tissues and organs of the body, being taken up by the blood and simply separated from it by the kidneys. Increase in the pressure of the blood in the kidneys increases URETERS.—the flow of urine. The excretory ducts of the kidneys are known as the ureters, and commence with the pelvis at the hilum. They are membraneous tubes of the diameter of a goose quill, and from sixteen to eighteen inches in length, passing from the kidneys COATS.—to the bladder. They have three distinct coats;—an external, fibrous; a middle, muscular; and an internal, mucous coat. The bladder which THE BLADDER.—serves as a reservoir for the urine, when empty is of triangular form, but when filled be-

comes of an ovoid shape, and will hold normally
COATS.—about a pint. It has three coats,—an exter-
nal, peritoneal; a middle, muscular; and an internal,
URETHRA.—mucous coat. The bladder is emptied
by a tube known as the urethra.

URINE.—The urine is of a yellowish or amber
QUANTITY.—color, and about fifty fluid ounces are
SPECIFIC GRAVITY.—voided in a day, being of a specific
REACTION.—gravity of 1015 to 1025. Its reaction is
usually acid although it depends upon the kind of
food, and therefore under circumstances may be alka-
UREA.—line. Urea, the most important of the uri-
nary constituents, is one of the few organic proximate
principles that the chemist can produce by synthesis.
It crystallizes in long, four sided, colorless, transparent,
neutral prisms; and is produced in the nitrogenized
parts of the organism. Uric and hippuric acids, cre-
atine and creatinine, together with many inorganic
constituents, such as chlorides, sulphates, and phos-
phates, are found in the urine. The composition of
urine is influenced by sex, season of the year, time of
day, digestion, temperature, sleep, exercise, etc.

THE LIVER.—The liver is the largest gland in
SITUATION.—the body, and lies just below the dia-

phragm in the right hypochondriac region, and WEIGHT.—weighs about four and a half pounds. It is CAPSULE OF GLISSON.—covered by a membrane called the capsule of Glisson, and in substance is made up of an innumerable number of irregular lobules. At PORTAL VEIN.—the transverse fissure, the portal vein, collecting blood from the abdominal organs; the hepatic artery, a branch of the cœliac axis, and the hepatic duct, penetrate the substance of the liver. The portal vein is the larger of the two bloodvessels. The INTERLOBULAR VEINS.—branches of the portal vein going between the lobules, are known as the interlobular veins. From the interlobular veins come LOBULAR VEINS.—eight to ten branches, penetrating the lobules and known as the lobular veins. These INTRALOBULAR VEINS.—empty in the centre of each lobule into a vein coming from it, known as the intralobular vein. It pours its contents into the sub- SUBLOBULAR VEINS.—lobular veins, and they in HEPATIC VEINS.—turn empty into three hepatic veins, which discharge the blood from the liver into HEPATIC ARTERY.—the vena cava ascendens. The hepatic artery brings blood to nourish the structure of HEPATIC DUCT.—the liver. The hepatic duct

carries away the bile, and is the result of the union of two ducts;—one from the right, and the other from the left lobe of the liver.

GALL BLADDER.—The gall bladder is a pear-shaped sac, four inches in length, lying under the liver
CYSTIC DUCT.—and emptied by a spiral duct,—the cystic duct. The spiral condition aids the ascent of
COMMON DUCT.—the bile against gravitation. The hepatic duct and the cystic duct unite to form the ductus communis choledochus, which opens into the intestine.

FUNCTION OF LIVER.—The liver is a secreting and excreting organ, and a ductless gland. It secretes
AMOUNT OF BILE SECRETED.—two and a half pounds of bile in a day, which during the intervals of
THE BILE.—digestion is stored in the gall bladder. Bile is a viscid, dark yellowish green secretion. That coming from the gall bladder is the darkest in color. It has a specific gravity of from 1020 to 1026, and contains two classes of constituents,—elements of secretion, which are absorbed; and an element of excretion, which is discharged by the fæces in an altered
CHOLESTERINE.—form, namely, cholesterine.
BILIVERDINE.—Biliverdine is the coloring matter of

the bile. As sugar is always found in the blood of the hepatic veins, it is believed to be formed by the liver, and that it is independent of the sugar and starch taken as food. This sugar forming function is supposed to be due to a material found in the substance of the liver called glycogen. It is this production of sugar that classes the liver among the ductless glands.

DUCTLESS GLANDS.—The ductless glands include the spleen, the supra-renal capsules, the thyroid and thymus glands, the pituitary body, and the pineal gland.

THE SPLEEN.—The spleen is situated in the left hypochondriac region at the cardiac extremity of the stomach, and is shaped like the tongue of a dog, having a vertical fissure, called the hilum, which gives passage to the veins and nerves. It has in its sub-

MALPIGHIAN BODIES.—stance about ten thousand bodies known as Malpighian bodies, or splenic corpuscles.

SUPRA-RENAL CAPSULES.—The supra-renal capsules are small, triangular, flattened bodies, capping the kidneys at their superior anterior end. They are about an inch and a half in length, of a whitish yellow color, and composed of two substances;—a cortical,

and a medullary. The bronzing of the skin in Addison's disease is due to a structural change in these bodies.

THYROID GLAND.—The thyroid gland is attached to the lower part of the larynx and is of a brownish red color. It is formed of two lateral lobes, and is larger and more prominent in the female than

THYMUS GLAND.—in the male. The thymus gland is found only in early life, as in the adult the organ is wanting, traces only of its previous existence remaining. It is situated partly in the thorax and partly in the neck, and is of a grayish color.

PITUITARY BODY AND PINEAL GLAND.—The pituitary body and pineal gland are situated at the base of the brain;—the former is ovoid in shape, of a reddish gray color, and situated on the sella turcica of the sphenoid bone: the latter is placed just behind the posterior commissure of the brain, and is a conical body about one-third of an inch in length. Nothing

FUNCTION OF DUCTLESS GLANDS.—is known of the function of these ductless glands.

NUTRITION.

NUTRITION.—Nutrition is the process by which the waste of the tissues and fluids of the body is repaired by the appropriation of new material. All the INORGANIC PRINCIPLES.—inorganic principles taken in with the food, generally pass out of the organism in the form in which they enter. About twenty-one inorganic principles exist in the human body. They are,—oxygen, hydrogen, nitrogen, carburetted hydrogen, sulphuretted hydrogen, water, chloride of sodium, chloride of potassium, phosphate of lime, carbonate of lime, carbonate of soda, carbonate of potassa, phosphate of magnesia, phosphate of soda, phosphate of potassa, sulphate of soda, sulphate of potassa, sulphate of lime, hydrochlorate of ammonia, carbonate of magnesia, and bicarbonate of soda. NITROGENIZED PRINCIPLES.—Nitrogenized principles of food have for their basis,—carbon,

hydrogen, nitrogen, and oxygen; and go toward making tissue in place of that which has been de-

EXERCISE.—stroyed. Nutrition is greatly influenced by exercise and diet. The non-nitrogenized elements

NON-NITROGENIZED PRINCIPLES.—are in themselves incapable of meeting the nutritive demands of the system, and are either consumed without forming part of the tissues or deposited as fat.

ANIMAL HEAT.—The process of nutrition is always accompanied by the development of heat. The normal temperature of man is 98° Fah. The general temperature of the body varies with extreme changes in climate, and the limit of this variation consistent with life is from 83° to 107° Fah. There is a variation in temperature in different parts of the body, and also at different periods of life. The temperature is increased by exercise. No portion of the organism is the seat of the production of heat, but every portion produces a part, as it is the necessary consequence of the processes of nutrition. Respiration, being one of the nutrient processes, has an intimate connection with calorification. The temperature of man can be equalized by the use of clothing. When from any cause there is a tendency to an undue elevation of

temperature, it is corrected by the evaporation of moisture produced by the sudoriparous glands. Man has thus been enabled to endure a temperature from 400° to 600° Fah.

MOVEMENTS.

MOVEMENTS.—In some of the lowest forms of life we have movements of elongation and retraction, CILIARY MOVEMENTS.—called amœboid. The epithelium covering certain of the mucous membranes is provided with hair like processes upon the free portion of the cells, called cilia; and these are in motion from the beginning to the end of life, producing currents upon the surfaces to which they are attached. The direction of the motion, is from within, outward. No reason has been given for the movements, they not being due to muscular or nervous intervention. Cer- ELASTIC MOVEMENTS.—tain movements of the body are due to the action of elastic ligaments or membranes. There are three kinds of elastic tissue;— small fibres,—found in the lungs; in the true skin, in

ligaments, etc.; large ribbon-shaped fibres,—found in ligaments; and the large flat fibres having many anastomoses.

MUSCULAR MOVEMENTS.—Muscular movements are divided into the voluntary and involuntary.

VOLUNTARY MUSCLES.—The voluntary muscles are invariably attached by their two extremities to movable parts, and are made up of red striated fibres called primitive fasciculi. A primitive fasciculus runs

PRIMITIVE FASCICULUS.—the entire length of the muscle, and is enclosed in its own sheath, known as the sarcolemma or myolemma. The involuntary

INVOLUNTARY MUSCLES.—muscles generally exist in sheets or membranes, made up of smooth fibres, excessively pale, very finely granular, and spindle-shaped, with a narrow nucleus in the centre.

CONNECTIVE TISSUE.—In muscles there is a fibrous structure which holds a number of primitive fasciculi in a bundle, and sometimes encloses these bundles to make a larger muscle. This fibrous tissue is the perimysium, now called connective tissue, and has an excessively thin and wavy fibre.

PROPERTIES OF MUSCLES.—Muscles have the property of elasticity, tonicity, sensibility, and con-

ELASTICITY.—tractility Their elasticity is brought into play in opposing sets of muscles, and by virtue of it one will retract when the opposing force of the other TONICITY.—is removed. Their tonicity is an insensible contraction by which the action of opposing muscles is balanced when both are in a state of repose. SENSIBILITY.—The sensibility of muscles is expressed in the sense of fatigue, and in their appreciation of weight and resistance. Their contractility CONTRACTILITY.—enables them to contract, and to exert a certain amount of mechanical force under proper stimulus. During muscular contraction the MUSCULAR CONTRACTION.—fibres harden and shorten. The actual volume of the muscle remains the same, although increased in thickness in propor- LOCOMOTION.—tion to the shortening. Locomotion is produced by muscles acting upon bones, ligaments, etc.

BONE.—Every bone is marked by microscopic cavities and canals of varying size. These cavities STRUCTURE.—contain bone corpuscles, and the larger canals serve for the passage of blood vessels. Many bones have in the centre a medullary cavity filled with marrow. Bones are of two kinds of structure,—the

compact or solid, and the spongy or cancellated; and are covered by a membrane called the periosteum.

HAVERSIAN CANALS.—The compact structure is filled with irregular microscopic excavations called LACUNÆ.—lacunæ, arranged in concentric lamellæ around central tubes called Haversian canals. Pass-

CANALICULI.—ing from the lacunæ to each other and to the Haversian canals are smaller tubes termed

CARTILAGE.—canaliculi. Cartilage is a whitish substance, not covered by a membrane, and made up either of a homogeneous fundamental substance filled with cartilage cells, or of fibrous tissue filled with the same.

VOICE.—The voice is produced in the larynx and modified by the mouth and nasal passages. The vocal

VOCAL CHORDS.—chords are in two pairs, stretched across the superior opening of the larynx from before backwards. The superior or false are not concerned in the production of the voice. The inferior or true chords are attached together to the middle of the thyroid cartilage, which is immovable; and posteriorly to the movable arytenoid cartilages. The muscles of

MUSCLES OF THE LARYNX.—the larynx are divided into the extrinsic and intrinsic. The extrinsic

muscles are attached to the outer surface of the larynx, and to adjacent organs; while the intrinsic are attached to the larynx itself, and by their action are capable of modifying the voice.

MUSCLES MODIFYING THE VOICE.—The muscles concerned in modifying the voice are,—the crico-thyroids, the arytenoid, the lateral crico-arytenoids, and the thyro-arytenoids. The crico-thyroid CRICO-THYROID MUSCLES.—muscles arise from the anterior and lateral portions of the cricoid cartilage, and are inserted into the inferior border of the thyroid ARYTENOID MUSCLE.—cartilage. The arytenoid muscle fills up the space between the two arytenoid cartilages, being inserted into their posterior borders. LATERAL CRICO-ARYTENOID.—The lateral crico-arytenoids are situated in the interior of the larynx, arising from the sides and superior borders of the cricoid cartilage, and becoming inserted into the base of the arytenoid cartilages. The thyro-arytenoid THYRO-ARYTENOID MUSCLES.—muscles arise from the crico-thyroid membrane and the thyroid cartilage, and are inserted into the arytenoid cartilages. QUALITY OF VOICE.—The variations in the quality of voice depend upon differences in size and form

of the larynx and vocal chords, the trachea being an assessory vocal organ.

SPEECH.—Speech is the production of articulate LANGUAGE.—sounds. Language is a conventional series of sounds made for the purpose of conveying certain ideas.

NERVOUS SYSTEM.

NERVOUS SYSTEM.—A nervous system is composed of a single ganglion, or of two or more ganglia joined together. There are two kinds of nervous matter,—nerve cells, and nerve fibres; or the gray or vesicular, and the white or tubular. A union of white
A GANGLION.—and gray matter is called a ganglion.
THE GRAY MATTER.—The gray matter is composed of cells having a distinct nucleus and nucleoli,
FUNCTION.—and is the only kind of nervous matter capable of generating the so-called nervous force. On these cells are prolongations known as the poles, and the cells possessing them are called caudate. If they have one prolongation they are known as a unipolar cell; if two, as a bipolar; if three or more, as a multipolar; or when existing without any, as apolar cells.
THE WHITE MATTER.—The white nervous matter

is tubular in its appearance, and serves only as a conductor, being incapable of generating nervous force. It exists in two varieties,—the medullated, and the non-medullated fibres. It shows on examination an NEURILEMMA.—outer covering,—the neurilemma; WHITE SUBSTANCE.—a substance beneath,—the AXIS-CYLINDER.—white substance of Schwann; ULTIMATE NERVE FIBRE.—and inside of all the axis-cylinder. The latter is the essential element of the tissue, and passing through it are the ultimate nerve MEDULLATED FIBRES.—fibres. Medullated fibres are those which have the white substance of Schwann between the neurilemma and the axis-cylinder; while NON-MEDULLATED FIBRES.—the non-medullated fibres are simple prolongations of the axis-cylinder of the medullated fibres. An ultimate nerve fibre runs from its beginning to its end without uniting with any other, although it may pass from the sheath of one nerve into that of another.

MOTOR AND SENSORY NERVES.—Nerves conveying motor stimulus are motor nerves. Sensory ones convey sensory impressions. The motor nerves TERMINATION OF NERVES.—terminate in the voluntary muscles by granular plates; in the involun-

tary, by forming a plexus; while nerves sent to glands terminate in a somewhat similar manner to those in involuntary muscles. The sensory nerves terminate either by free extremities, by passing into hair follicles, or by corpuscles constructed for the purpose, viz.—the corpuscles of Pacini, tactile corpuscles, and

CORPUSCLES OF PACINI.—terminal bulbs. The corpuscles of Pacini or of Vater are egg-shaped, and consist of several layers of connective tissue enclosing a central bulb, in which is placed the terminal end of the nerve. These corpuscles are situated beneath the

TACTILE CORPUSCLES.—true skin. The tactile corpuscles are found in parts endowed with tactile sensibility, and in the substance of the papillæ of the skin. They are oblong in shape and have the nerve fibres in a spiral bundle. The terminal bulbs are

TERMINAL BULBS.—somewhat similar to the tactile corpuscles in structure, but are much smaller.

COMPOSITION OF NERVOUS TISSUE.—Nerve substance is principally made up of protagon, neurine, and fatty matters combined with phosphorus.

REGENERATION OF NERVOUS TISSUE.—It can be regenerated with the re-establishment of func-

NERVOUS IRRITABILITY.—tion. Nervous irri-

tability is that condition by which nerves respond to, and conduct stimulation. This condition of the motor nerve is distinct from that of the sensory;—in one it may be destroyed, and in the other remain intact.

NERVOUS FORCE.—Nervous force is a peculiar one, and generated by the gray substance, nothing being known of its essential nature except that it is not identical with electricity.

RAPIDITY OF CONDUCTION.—The rate of nervous conduction is one hundred and eleven feet per second, being the same in

ELECTRICITY.—motor and sensory nerves. Electricity is the best means of artificially exciting the nerves.

DIVISIONS OF THE NERVOUS SYSTEM.—The nervous system is divided into three great divisions;—the cerebro-spinal, the true spinal, and the great sympathetic.

THE CEREBRO-SPINAL SYSTEM.—The cerebro-spinal or voluntary nervous system includes the brain and spinal cord, with the nerves directly connected with these centres.

THE TRUE SPINAL SYSTEM.—The true spinal, reflex or involuntary system is composed of the spinal cord as a centre, and the nerves arising from it.

THE GREAT SYMPATHETIC SYSTEM.—The great

sympathetic or ganglionic system is composed of a chain of ganglia, situated on either side of the spinal column, and joined together at the os coccyx.

THE BRAIN.—The average weight of the brain in WEIGHT:—man is forty-nine ounces; in woman, forty-SPECIFIC GRAVITY.—four ounces. Its specific gravity is 1036; that of the gray matter being 1034; and of the white, 1040. In the brain the white matter is found on the inside; and the gray, upon the outside. DIVISIONS.—The brain is divided into the cerebrum, the cerebellum, the pons varolii, and the medulla oblongata. It is covered by three membranes,—the dura mater, the arachnoid, and the pia mater. It is situated in the brain case, an expanded vertebra. The dura DURA MATER.—mater is closely adherent to the bones of the brain case. The arachnoid membrane is ARACHNOID MEMBRANE.—serous, and exists in PIA MATER.—two layers. The pia mater is a vascular membrane.

THE CEREBRUM.—The cerebrum is divided into two hemispheres,—a right and a left; and constitutes four-fifths of the encephalic mass. It is thrown into convolutions for the purpose of increasing the gray FUNCTION.—matter, and presides over the intellectual

faculties. The faculty of articulate language is restricted to the anterior lobes of the cerebrum.

THE CEREBELLUM.—The cerebellum lies beneath the posterior lobes of the cerebrum and presides FUNCTION.—over co-ordination of muscular move-

CORPORA STRIATA.—ments. At the base of the brain, partly imbedded in the white substance of the cerebral hemispheres, are two pear-shaped bodies, made up of alternate striæ of white and gray matter, called the corpora striata, their narrow extremities being extended backward. Very little is known about their function,—they seem to be connected with the motor nerves. Between the narrow extremities of the

OPTIC THALAMI.—corpora striata are the optic thalami,—oblong bodies, having an internal mixture of gray and white matter, and seeming to be connected with the sensory nerves. The tubercula quadrigemina

TUBERCULA QUADRIGEMINA.—are oblong bodies, situated two on each side, just below the third ventricle. The larger and anterior two are called the nates; the posterior, the testes. They are composed of white and gray matter, and are the main points of FUNCTION.—the origin of the optic nerves, presiding over the sense of sight.

PONS VAROLII.—The pons or tuber annulare is white externally, but has gray matter on the inside. It acts as a conductor of sensory impressions and motor FUNCTION.—stimulus to and from the cerebrum. Being able to act as a nervous centre and give rise to voluntary movements, it probably regulates the movements of progression and station.

MEDULLA OBLONGATA.—The medulla oblongata is the oblong enlargement that connects the spinal cord with the brain. Like the cord it has an anterior and posterior median fissure. Continuous with the ANTERIOR PYRAMIDS.—anterior columns of the cord CORPORA OLIVARIA.—are two anterior pyramids. External to these are the corpora olivaria; and external CORPORA RESTIFORMI.—to them are the corpora restiformi which are continuous with the posterior columns FOURTH VENTRICLE.—of the cord. The fourth ventricle is in the medulla. The medulla plays the FUNCTION OF MEDULLA.—part of a conductor to and from the brain, presiding also over respiration, and is the seat of life.

THE SPINAL CORD.—The spinal cord is composed of gray matter on the inside, and white matter on the outside. It has three distinct covering mem-

branes called by the same names as those covering the brain, which they resemble in appearance. The dura mater of the cord, however, is separated from the POSITION.—bones of the vertebral column. The cord lies in a canal formed by a series of vertebra piled one LENGTH.—upon another, its length being seventeen WEIGHT.—inches, and its weight about an ounce and a half. Between the two layers of the arachnoid membrane is the cavity of the arachnoid, and beneath them is the sub-arachnoidean space. The cord is aided LIGAMENTUM DENTICULATUM.—in maintaining its position by the ligamentum denticulatum. It is marked by an anterior and posterior median fissure, by anterior and posterior lateral grooves and by transverse fissures. It has a central canal extending its entire length and connected with the fourth ventricle. Given off from the spinal cord are thirty-one pairs of nerves arising from the lateral grooves by anterior and posterior roots. The anterior roots are motor; and the posterior, sensory. The latter differ from the former in having a little body called a ganglion situated upon them a short distance from their origin. The gray matter is probably inexcitable GENERAL PROPERTIES OF THE CORD.—and

insensible under direct stimulation. The anterior lateral columns are insensible but excitable both on their surface and in their substance. The surface of the posterior columns is very sensitive, but their deep portion is probably insensible. The white substance

THE CORD AS A CONDUCTOR.—aided by the gray of the anterior columns transmits voluntary motor stimulus from the brain. The posterior columns transmit sensory impressions to the brain, and that too, exclusively by the gray matter. The motor and sensory fibres decussate within the cord. The cord

THE CORD AS A CENTRE.—acts as a nervous centre generating the stimulus of reflex movements.

REFLEX MOTION.—Reflex motion is any generation of motor nerve force occurring as the result of an impression received by a nervous centre.

THE CRANIAL NERVES.—The cranial nerves are divided into twelve pairs by Sömmering, and into nine pairs by Willis, as follows:—

Willis.	Name.	Sömmering.
1st.	Olfactory.	1st.
2nd.	Optic.	2nd.
3rd.	Motor oculi communis.	3rd.
4th.	Patheticus.	4th.

Willis.	Name.	Sömmering.
5th.	Trifacial.	5th.
6th.	Motor oculi externus.	6th.
7th.	Facial.	7th.
	Auditory.	8th.
8th.	Glosso-pharyngeal.	9th.
	Pneumogastric.	10th.
	Spinal accessory.	11th.
9th.	Sublingual.	12th.

THE OLFACTORY NERVE.—The olfactory nerve is a special nerve of smell. The optic is a THE OPTIC NERVE.—special nerve of sight.

THE MOTOR OCULI COMMUNIS.—The motor oculi communis arises from the optic thalamus, and passing out of the brain case through the sphenoidal fissure, is distributed to the superior rectus muscle, to the internal rectus, to the inferior rectus, to the inferior oblique, and to the lenticular ganglion of the sympathetic. This last distribution is supposed to give motor stimulus to the iris.

THE PATHETICUS.—The patheticus or trochlearis is a motor nerve arising from the valve of Vieussens, and passing into the orbit through the sphenoidal fissure. It is distributed to the superior oblique muscle.

THE TRIFACIAL.—The trifacial or trigeminal nerve arises in a similar manner to the spinal nerves,—by an anterior, motor; and a posterior, sensory root with a ganglion upon it. It is the great sensitive nerve of the face. The roots arise from the fourth ventricle,—the posterior one being the largest. The ganglion is called the ganglion of Gasser, or Casser, or semilunar ganglion, and is situated on the petrous portion of the temporal bone. At this ganglion the nerve receives branches from the carotid plexus of the sympathetic. The posterior root enters the concave side of the ganglion and coming from its convex side are three branches;—the ophthalmic, the superior maxillary and the inferior maxillary.

OPHTHALMIC BRANCH.—The ophthalmic branch is the smallest of the three divisions, and just before it enters the orbit by the sphenoidal fissure, it divides into three branches;—the lachrymal, frontal,

LACHRYMAL BRANCH.—and nasal. The lachrymal, the smallest of the three, sends a branch to the orbital of the superior maxillary; then passes through the lachrymal gland, giving filaments to it, and is finally distributed to the conjunctiva and upper eyelid.

FRONTAL BRANCH.—The frontal branch, the

largest of the three, divides into the supra-trochlear and the supra-orbital nerves. The supra-trochlear passes

THE SUPRA-TROCHLEAR BRANCH.—out of the orbit between the supra-orbital foramen and the pulley of the superior oblique muscle. It sends a filament to the nasal branch and becomes lost in the integument of the forehead. The supra-orbital passes

THE SUPRA-ORBITAL BRANCH.—through the supra-orbital foramen, dividing into muscular, cutaneous, and pericranial branches. It is distributed to the eyelids, forehead, mucous membrane of frontal sinuses, and to the scalp. The nasal branch before

THE NASAL BRANCH.—entering the orbit gives off a filament to the ophthalmic, ciliary, or lenticular ganglion, from which come the short ciliary nerves distributed to the ciliary muscle and iris. The nasal

CILIARY NERVES.—then gives off the long ciliary nerves, which are distributed with the short and in the same manner. Just before it enters the cranium it

THE INFRA-TROCHLEAR NERVE.—gives off the infra-trochlear branch, which is joined by a filament from the supra-trochlear nerve. They pass to the nose, eyelid, conjunctiva, orbicularis palpebrarum, and lachrymal sac. The original nasal nerve then

enters the cavity of the cranium by the anterior ethmoidal foramen, and traverses a groove on the cribriform plate of the ethmoid bone, passing down through a slit by the side of the crysta galli into the nose, where it divides into the external and internal nasal.

INTERNAL NASAL NERVE.—The latter supplies the mucous membrane of the nose, while the former

EXTERNAL NASAL NERVE.—slips out between the cartilages and is distributed to the integument of the ala and tip of the nose. Both of these branches join with the nasal branch of the superior maxillary.

SUPERIOR MAXILLARY NERVE.—The superior maxillary branch of the fifth, gets out of the cranial cavity by the foramen rotundum, traverses the spheno-maxillary fossa in which it gives off the orbital branch, that enters the orbit by the spheno-maxillary fissure. It then divides into two branches, the temporal and the malar. The temporal branch receives a filament from the lachrymal, and then passes through a foramen in the temporal bone, entering the temporal fossa, to be

THE TEMPORAL NERVE.—distributed to the integument of the temple and side of the forehead. It communicates with the auriculo-temporal of the inferior maxillary nerve, and with the facial. The malar

THE MALAR NERVE.—branch comes upon the face through a foramen in the malar bone and joins with the facial and palpebral branch of this second division. In the spheno-maxillary fossa are also given SPHENO-PALATINE NERVES.—off two branches known as the spheno-palatine, which pass to the sphe- SPHENO-PALATINE GANGLION.—no-palatine or Meckel's ganglion. This ganglion is situated close to the spheno-palatine foramen, and is triangular in shape. From it are given off ascending branches ASCENDING BRANCHES.—which enter the orbit by the spheno-maxillary fissure, and supply the periosteum; and descending branches, palatine, which are distributed to the roof of the mouth, being three in number;—anterior, middle, and posterior palatine. The ANTERIOR PALATINE NERVE.—anterior palatine descends through the posterior palatine canal, and emerges at the hard palate at the posterior palatine foramen, supplying the gums and mucous membrane of NASAL BRANCHES.—the hard palate. The anterior palatine gives off nasal branches. The middle pal- MIDDLE PALATINE NERVE.—atine descends in the same canal with the anterior, and is distributed to the uvula and tonsil. The posterior palatine passes

POSTERIOR PALATINE NERVE.—through the posterior palatine canal, emerging by a separate opening from the other palatine branches, to supply the soft palate. From the posterior portion of Meckel's VIDIAN NERVE.—ganglion comes the vidian nerve, which is distributed to the lining membrane of the PHARYNGEAL NERVE.—roof of the nose; and a pharyngeal branch, distributed to the pharynx. The NASAL AND NASO-PALATINE NERVES.—nasal and naso-palatine branches are given off from the ganglion, and go to the lining of the ethmoid cells, and to the mucous membrane of the mouth. The posterior POSTERIOR DENTAL NERVES.—dental branches arise from the superior maxillary, just before it enters the infra-orbital canal, and are two in number,—the anterior and the posterior. The anterior is distributed to the gums and buccinator muscle; while the posterior branch enters the substance of the superior maxilla, to join the anterior dental, supplying the lining membrane of the antrum, and the pulps and gums of the molar and bicuspid teeth. The superior maxillary ANTERIOR DENTAL NERVE.—nerve then enters the infra-orbital canal, and gives off the anterior dental branch which unites with the posterior branch of

the posterior dental, and is distributed to the incisor, canine, and first bicuspid teeth. Passing on, the superior maxillary nerve emerges upon the face through the infra-orbital foramen, and divides into the palpebral, labial, and nasal branches. The palpebral PALPEBRAL NERVE.—branches are distributed to the orbicularis palpebrarum, and to the integument and conjunctiva of the lower eyelid, joining with the facial nerve, and malar branch of the orbital. The NASAL NERVE.—nasal branches supply the muscles and integument of the side of the nose, and join with the nasal branch of the ophthalmic. The labial LABIAL NERVE.—branches are distributed to the muscles and integument of the upper lip, and form the ganglion of Cloquet.

INFERIOR MAXILLARY NERVE.—The inferior maxillary nerve is the largest of the three divisions of the fifth, and includes in its composition the motor root of the fifth pair which joins with it just after it leaves the brain case by the foramen ovale. Outside the cranium it divides into two trunks,—an anterior and a posterior. The anterior or smaller ANTERIOR DIVISION.—division receives almost all of the motor root, and divides into five branches;

—the masseteric, deep temporal, buccal, external and internal pterygoid; which are distributed to muscles
POSTERIOR DIVISION.—of the same names. The posterior and larger division of the inferior maxillary divides into three branches,—the auriculo-temporal, gustatory, and inferior dental. The auriculo-temporal
AURICULO-TEMPORAL NERVE.—divides into the anterior and the posterior temporal. The anterior
ANTERIOR TEMPORAL NERVE.—temporal supplies the integument of the temporal region. The
POSTERIOR TEMPORAL NERVE.—posterior temporal supplies the integument of the ear, and joins with the temporal branch of the superior maxillary.
GUSTATORY NERVE.—The gustatory or lingual nerve is distributed to the mucous membrane of the tongue as far as the point, giving branches to the submaxillary ganglion, and receiving an important branch from the facial,—the chorda tympani, which is supposed to give to the gustatory its sense of taste. The
INFERIOR DENTAL NERVE.—inferior dental, the largest division of the inferior maxillary, gives off just
MYLO-HYOID NERVE.—before it enters the dental foramen, the mylo-hyoid nerve to supply the mylo-hyoid and digastric muscles. It then enters the dental

foramen, traverses the dental canal in the inferior

INCISOR BRANCH.—maxillary bone as far as the mental foramen, where it divides into the incisor, and

MENTAL BRANCH.—the mental branch. The latter emerges from the bone at the mental foramen, dividing into external and internal branches, which are distributed to the structure of the lip. In the canal branches are given off which supply the teeth of the

THE OTIC GANGLION.—lower jaw. The otic or Arnold's ganglion is an oval-shaped body, situated below the foramen ovale, on the inner surface of the inferior maxillary nerve. The large root of the tri-

FUNCTIONS OF THE TRIFACIAL NERVE.—facial is exclusively a sensory nerve, therefore its branches,—the superior maxillary and ophthalmic, and the nerves arising from them are sensory only. The inferior maxillary including the motor root is therefore both motor and sensory. Thus the fifth pair is a mixed nerve in its functions;—being motor, sensory, and a nerve of special sense.

MOTOR OCULI EXTERNUS NERVE.—The motor oculi externus arises from the floor of the fourth ventricle, enters the orbit by the sphenoidal fissure,

FUNCTION.—and is distributed to the external rectus muscle to give it motor stimulus.

AUDITORY NERVE.—The auditory, or portia mollis of the seventh pair, is a special nerve of hear-
FACIAL NERVE.—ing. The portia dura, the other division of this pair, arises from the floor of the fourth ventricle, passes in connection with the auditory and intermediary nerve of Wrisberg into the internal auditory meatus. At the bottom of the meatus, the facial nerve and the nerve of Wrisberg enter the aqueductus Fallopii, and pass through the petrous portion of the temporal bone, where the intermediary nerve unites with the main root forming the common trunk of the facial, which emerges by the stylo-mastoid foramen.
LARGE PETROSAL NERVE.—In the aqueductus Fallopii the facial gives off the large petrosal branch,
SMALL PETROSAL NERVE.—which goes to Meckel's ganglion; the small petrosal, which goes to the
TYMPANIC NERVE.—otic ganglion; the tympanic branch to the stapedius muscle; the chorda tympani
CHORDA TYMPANI NERVE.—to the lingual branch of the inferior maxillary; and a branch to the pneumogastric. After passing out of the stylo-mastoid
POSTERIOR AURICULAR NERVE.—foramen,

it sends a branch to the glosso-pharyngeal; one to the stylo-hyoid muscle; the posterior auricular nerve to the occipito-frontalis muscle and those around the ear; DIGASTRIC NERVE.—and the digastric branch to the digastric muscle. The trunk then passes through the parotid gland and divides into the temporo-facial, which is distributed to the superficial muscles of the upper part of the face; and into the cervico-facial which passes to supply the muscles in the lower part of the face. The facial nerve is the motor nerve of FUNCTIONS OF THE FACIAL NERVE.—the superficial muscles of the face, and is the only nerve that animates the buccinator muscle.

GLOSSO-PHARYNGEAL NERVE.—The glosso-pharyngeal is the first division of the eighth pair of nerves, and is a nerve of taste.

PNEUMOGASTRIC NERVE.—The pneumogastric, the second division of this pair, arises from the floor of the fourth ventricle, enters in the jugular foramen into the jugular ganglion, and then makes its exit from the cranial cavity by the jugular foramen, or posterior foramen lacerum. It receives filaments of communication from the spinal accessory, facial, and sublingual nerves; and from the sympathetic nervous

system. It gives off the auricular branch to the integ-
AURICULAR BRANCH.—ument around the exter-
nal auditory meatus; the pharyngeal nerves which go
PHARYNGEAL NERVES.—to the muscles and mu-
cous membrane of the pharynx; the superior laryngeal
SUPERIOR LARYNGEAL NERVES.—which give
sensibility to the upper part of the larynx, animating
the crico-thyroid muscle and the inferior constrictor
of the pharynx; the inferior laryngeal which animate
INFERIOR LARYNGEAL NERVES.—the intrinsic
muscles of the larynx, except the crico-thyroid; the
CARDIAC NERVES.—cardiac branches which go
PULMONARY NERVES.—to the cardiac plexus;
the pulmonary branches distributed to mucous mem-
ŒSOPHAGEAL NERVES.—brane; the œsophageal
branches distributed to the muscular and mucous tissue
of the lower part of the œsophagus; and the abdomi-
ABDOMINAL BRANCHES.—nal branches which
pass to the stomach and organs in the abdominal cav-
FUNCTIONS OF PNEUMOGASTRIC NERVE.—
ity. The pneumogastric nerve being in its origin
strictly sensory, gives sensibility around the ear, to the
pharynx, and to the upper part of the larynx; regulates
the protection of the air passages; has to do with the

reflex action of deglutition, the vocal and respiratory movements, the action of the heart, the movements of the œsophagus; and influences the abdominal organs.

SPINAL ACCESSORY NERVE.—The spinal accessory, the third division of the eighth nerve, arises in part from the lower portion of the medulla oblongata, and in part from the cervical portion of the spinal cord. It enters the cranial cavity by the foramen magnum, and emerges by the jugular foramen. It ANASTOMOTIC BRANCH.—divides into the internal or anastomotic branch which passes to the pneumogastric nerve, and through its recurrent laryngeal to the larynx; and into an external or muscular branch MUSCULAR BRANCH.—which is distributed to the sterno-cleido-mastoid and trapezius muscles. The true FUNCTIONS OF THE SPINAL ACCESSORY.—origin of the spinal accessory is motor in its nature, and besides supplying the above-named muscles, it gives motor influence to the distribution of the pneumogastric.

SUBLINGUAL NERVE.—The sublingual or hypoglossal nerve arises from the floor of the fourth ventricle, and passes out of the cranial cavity through the anterior condyloid foramen. It then gives off the

DESCENDENS NONI—descendens noni to the sterno-hyoid, sterno-thyroid, and omo-hyoid muscles; and THYRO-HYOID NERVE.—the thyro-hyoid branch to the thyro-hyoid muscles. Its other branches go to the stylo-glossus, hyo-glossus, genio-hyoid, and genio-hyo-glossus and intrinsic muscles of the tongue. The FUNCTIONS OF THE SUBLINGUAL.—sublingual is a motor nerve, and its functions are connected with the tongue in articulation and digestion.

SYMPATHETIC NERVOUS SYSTEM.—The sympathetic nervous system is composed of from twenty-eight to thirty ganglia, on either side of the spinal column, terminating below in the ganglion of FUNCTIONS.—impar. It presides over the functions of animal life, and has an important influence upon nutrition, calorification, and secretion.

VASO-MOTOR NERVES.—The vaso-motor nerves are distributed from the cerebro-spinal system to the bloodvessels to regulate their calibre.

THE SPECIAL SENSES.

VISION.—The optic nerves arise from the tubercula quadrigemina, and pass to the optic commissure or chiasm which rests upon the olivary process of the
OPTIC COMMISSURE.—sphenoid bone, and is the point of union between the nerves of the two sides. The fibres of each side divide here, a part going to the eye of their own side, and a part to the eye of the other side. The optic nerves are not endowed with general sensibility, and only convey the impressions of sight. Any irritation of them produces the impression of light.

THE EYEBALL.—The eyeball is spheroidal and placed in a cushion of fat in the orbit, and has three
SCHLEROTIC COAT.—coats. The outer one is called the schlerotic on account of its hardness, and is dense, opaque and fibrous. It covers the posterior five-sixths of the globe being continuous with the cor-

CORNEA.—nea,—a transparent dense resisting membrane, which covers the anterior one-sixth of the eyeball. The cornea is made up of complete and distinct layers, which allow the passage of light. It is inserted into the schlerotic coat in the same manner that the watch-crystal is into its bevel. The second CHOROID COAT.—coat, the choroid, is of a dark color and highly vascular. It is lined by a layer of PIGMENTUM NIGRUM.—black pigment, called the pigmentum nigrum, which prevents too great reflection of the rays of light in the eye. The anterior CILIARY PROCESSES.—portion of the choroid coat is thrown into about sixty or eighty folds, called the ciliary processes, and arranged around the margin of CILIARY MUSCLE.—the crystalline lens. The ciliary muscle is an organ of great importance, as it aids in accommodating the eye to different distances. It surrounds the anterior margin of the choroid coat, and acts to tighten this coat over the vitreous humor. IRIS.—The iris is made up of circular and transverse muscular fibres, and corresponds to the diaphragm of optical instruments. It is circular and is situated in front of the crystalline lens, with a perforation in its PUPIL.—centre,—the pupil. The color of the iris,

due to pigmentary cells, is different in different individuals. The circular fibres contract, and the transverse dilate the pupil. Across the pupil in foetal life

PUPILLARY MEMBRANE.—is the pupillary membrane.

RETINA.—The third coat of the eye, the retina, is essentially an expansion of the optic nerve; and is an important structure as it is endowed with the sense of sight. It consists of a delicate transparent membrane. The optic nerve penetrates the retina a little internal and below the antero-posterior axis. It

BLIND SPOT.—is perforated in its centre for the

ARTERIA CENTRALIS RETINA.—passage of the central artery of the retina, thus making the blind

MACULA LUTEA.—spot of the eye. External to the point of penetration of the nerve is the yellow spot of Sömmering, or macula lutea,—the most sensitive point of the retina. The retina is made up of

RODS AND CONES —layers. The layer of rods and cones is situated next to the choroid coat, and above it are four granular layers, covered by one of nerve-cells and nerve fibres. In apposition with the hyaloid membrane of the vitreous humor, is the membrana limitans. The rods are supposed to take cognizance of the color of light; and the cones, the quantity or intensity.

CRYSTALLINE LENS.—In the eye is a double convex, transparent, and elastic lens, having a function in the refraction of the rays of light. It is situated behind the pupil in the hyaloid fossa of the vitreous humor. It is more convex on its posterior, than on its anterior surface; and is composed of lay-
CAPSULE OF LENS.—ers of fibres of different densities, covered by a capsule which is an exceedingly thin, elastic membrane. The hyaloid membrane of the vitreous humor is attached to the capsule of the lens forming its suspensory ligament. The folds of
ZONE OF ZINN.—the ligament are received between the folds of the ciliary processes, and are known as
AQUEOUS HUMOR.—the zone of Zinn. The space bounded in front by the cornea, and posteriorly by the crystalline lens, is filled with a clear liquid known as the aqueous humor. This substance is faintly alkaline, and has a specific gravity of 1005.
ANTERIOR CHAMBER.—The portion of this space between the anterior face of the iris and the cornea, is called the anterior chamber; and that between the
POSTERIOR CHAMBER.—posterior face of the iris and the capsule of the lens, is known as the posterior
VITREOUS HUMOR.—chamber of the eye. The

vitreous humor is a clear, glassy substance, enveloped by a hyaloid membrane, situated in the posterior two-thirds of the globe. It is alkaline in reaction and has a specific gravity of 1005.

LIGHT.—The theory of undulation as regards light is accepted to-day and the emission theory of Newton rejected. According to the former all space is filled with an ether, and light is propagated by VELOCITY.—a vibration of it. The velocity of light COLOR.—is 192,000 miles in a second and the color is determined solely by its wave length. When white COMPOSITION.—light is decomposed it gives seven colors;—violet, indigo, blue, green, yellow, orange, REFLECTION.—and red. A ray of light falling on a smooth, polished surface, is reflected in the opposite direction at the same angle as that from which it comes. The ray which thus falls is called the incident ray, and the other the reflected ray. The angle produced by the former with the perpendicular, is termed the angle of incidence; and that by the perpendicular and the latter, the angle of reflection. The angle of reflection REFRACTION.—is always equal to the angle of incidence. Light which passes from a rarer to a denser medium, or the reverse, is always bent or refracted from its course.

SPHERICAL ABERRATION.—Spherical aberration is the absence of sphericity, and is caused by the rays of light not forming a single focus. Chromatic aber-

CHROMATIC ABERRATION.—ration is the decomposition of the ray of light into the colors of the spectrum, and is the result of the unequal action of the refracting medium. In optical instruments chromatic aberration is corrected by a combination of lenses made of crown and flint glass.

ASTIGMATISM.—Astigmatism is that disease of the eyes, in which one sees the lines of an object running in one direction, without seeing those running in

MOVEMENTS OF THE IRIS.—another. The movements of the iris are reflex, acting under the stimulus of light. The eye is accommodated to differ-

ACCOMMODATION OF THE EYE TO DISTANCE.—ent distances by changing the convexity of the lens. The range of vision varies between five in-

PRESBYOPIA.—ches and infinity. Presbyopia, or long sightedness, is corrected by the use of convex

MYOPIA.—lenses. Myopia, or short sightedness, by concave ones.

ERECT VISION.—The retina does not perceive as a whole organ, but each individual bacillus in it

perceives its share of the picture formed upon the general surface; and as the bacilli stand radially upon the inner aspect of the eyeball, they are so directed that each will see its part of the object in the proper position.

DURATION OF IMPRESSIONS.—Impressions made upon the retina remain the sixth of a second.

MUSCLES OF THE EYEBALL.—The muscles which move the globe of the eye are;—the external and internal recti, superior and inferior recti, and two oblique muscles.

CANTHUS.—The eye is protected by eyelids. The outer and inner angles formed by these lids, are known as the outer and inner canthus.

CONJUNCTIVA.—The principal muscles which open and close the eyelids are the orbicularis palpebrarum, and the levator palpebræ superioris.

LACHRYMAL GLAND.—The inner surface of the lids is lined by a mucous membrane, which is reflected over the eyeball, and is known as the conjunctiva.

PUNCTA LACHRYMALIA.—The eye-ball is constantly bathed by a thin, watery fluid, which is secreted by the lachrymal gland. The lachrymal gland is ovoid, flattened, and of the racemose variety. It is situated in the upper and outer part of the orbit.

The excess of the lachrymal secretion

is carried into the nose by the puncta lachrymalia, two minute openings situated one on each lid, near the inner canthus, and opening into the lachrymal canals.

LACHRYMAL CANALS.—These canals form the NASAL DUCT.—nasal duct, a tube half an inch in length, opening into the nose. On the borders of the lids are short, stiff hairs, curved away from the eye-ball, which serve to shade the eye and protect the MEIBOMIAN GLANDS.—globe from dust. Along the edges of the lids are the meibomian glands, which secrete an oily substance, that prevents the overflow of the tears.

AUDITION.—The auditory nerve constitutes the portia mollis of the seventh, and arising from the floor AUDITORY NERVE.—of the fourth ventricle enters the internal auditory meatus, where it divides into an anterior and a posterior branch. The anterior branch goes to the cochlea, and the posterior to the vestibule and semicircular canals. The auditory is a nerve of special sense, not endowed with general sensibility, and only capable of conveying impressions of sound.

EAR.—The ear is divided into the external, middle, and internal ears.

EXTERNAL EAR.—The external is made up of the
PINNA.—pinna or auricle, which is the portion pro-
HELIX.—jecting from the head. Externally in it is
the helix, which is the outer ridge of the pinna.
FOSSA OF HELIX.—Within this is a groove called
the fossa of the helix, bounded anteriorly by a shorter
ANTI-HELIX.—ridge called the anti-helix. Between
FOSSA OF ANTI-HELIX.—the superior portion of
the anti-helix and the anterior portion of the helix is
CONCHA.—the fossa of the anti-helix. The fossa
immediately around the opening of the meatus is
TRAGUS.—called the concha. A lobe projects pos-
ANTI-TRAGUS.—teriorly called the tragus. A pro-
jection at the lower part of the anti-helix is called the
LOBULE.—anti-tragus. The dependent portion of
the ear is called the lobule. The external auditory
EXTERNAL AUDITORY MEATUS.—meatus is
an opening about an inch and a quarter in length and
extends from the concha to the middle ear.

MIDDLE EAR.—The middle ear is a narrow
cavity of irregular shape, situated between the exter-
nal and the internal ear, in the substance of the
MEMBRANA TYMPANI.—temporal bone. Its outer
wall is formed by the membrana tympani, a concave

membrane, which inclines at an angle of forty-five degrees. The floor and roof are bone. The inner wall towards the internal ear presents elevations and fora-

FENESTRA OVALIS.—mina. The fenestra ovalis, an ovoid opening near its upper part, leads to the

FENESTRA ROTUNDA.—cavity of the vestibule; while below is a smaller opening,—the fenestra rotunda, leading to the cochlea. This cavity also pre-

EUSTACHIAN TUBE.—sents an opening, which leads by the eustachian tube to the upper part of the pharynx. The middle ear is lined by mucous membrane, which is continuous with that of the mastoid cells opening into the cavity. It contains the bones of the ear,—the incus, malleus, and stapes. The mal-

MALLEUS.—leus is so called from its being shaped like a hammer, and has its handle closely attached to

INCUS.—the membrana tympani. It articulates with the incus, so-called from its resemblance to an anvil, which in turn is connected with the posterior wall of

STAPES.—the cavity near the mastoid cells, and is articulated by its long process with the stapes, a stirrup shaped bone having its oval base applied to the fenestra ovalis. These bones are moved by muscles.

INTERNAL EAR.—The internal ear is contained

in the petrous portion of the temporal bone, and is
BONY LABYRINTH.—composed of an irregular cavity, called the vestibule, the semi-circular canals and the cochlea. It is named the bony labyrinth.
VESTIBULE.—The vestibule is the central chamber
SEMI-CIRCULAR CANALS.—of the labyrinth, and in its posterior wall are five openings leading to the semi-circular canals, and a larger one to the cochlea. The semi-circular canals are three in number. The
COCHLEA.—cochlea is a spiral canal about an inch and a half long, tapering to an apex, and making in
FENESTRA ROTUNDA.—its course two and a half turns. The fenestra rotunda, closed by a membrane
SECONDARY MEMBRANA TYMPANI.—called the secondary membrana tympani, is an opening by which the cochlea communicates with the middle ear.
MEMBRANOUS LABYRINTH.—The bony labyrinth is lined by periosteum, and contains a membra-
UTRICLE.—nous labyrinth. The membranous vestibule is divided into the utricle and saccule. The
SACCULE.—saccule opens into the membranous canal of the cochlea. At the point where the audi-
OTOLITHS.—tory nerve enters the saccule and utricle, are little masses of crystals of carbonate of lime

called otoliths. Otoliths also exist in the enlarged por-
AMPULLAE.—tions of the membranous semi-circu-
lar canals,—the ampullae. The membranous laby-
PERILYMPH.—rinth floats in a liquid called the
ENDOLYMPH.—perilymph, and within it is another
liquid called the endolymph. The organ of Corti is
ORGAN OF CORTI.—supposed to receive sonorous
vibrations, and to communicate them to the terminal
filaments of the auditory nerve. It is situated in the
quadrilateral canal throughout its spiral course. The
FUNCTION OF SEMI-CIRCULAR CANALS.—
semi-circular canals are supposed to appreciate quality
FUNCTION OF COCHLEA.—of sound; and the
cochlea, the wave lenth. The internal ear is the essen-
tial portion of the organ of hearing.

TOUCH.—The sense of touch is the appreciation of contact, and the result of the anatomical arrangement of the termination of the sensory nerves. This sense is capable of education, and of extraordinary development. It is most acute in those situations in which the tactile corpuscles are the most abundant. The appreciation of temperature is the result of the nerves of general sensibility.

SMELL.—The two irregular shaped cavities in the

middle of the face, opening in front by the anterior NASAL FOSSAE.—nares, and into the pharynx by the posterior nares, are called the nasal fossae. The SCHNEIDERIAN MEMBRANE.—mucous membrane lining these cavities is called the Schneiderian membrane, and in its upper half is the essential organ OLFACTORY NERVES.—of smell. The olfactory nerve arises from the inferior and internal portion of the anterior lobe of the cerebrum, and passes forward to the ethmoid bone, expanding beside the crysta galli into an oblong ganglion, called the olfactory bulb. From this bulb fifteen to eighteen filaments descend through the cribriform plate of the ethmoid into the nasal fossae, and are distributed to the mucous mem- FUNCTIONS.—brane. The olfactory nerves being special nerves of smell are insensible to ordinary impressions. The mechanism of olfaction consists in the contact of material emanations of odorous substances with the nerves of smell. The sense of smell is closely related to the sense of taste, and we lose the delicacy of the sense of taste when the sense of smell is abolished.

GUSTATION.—The sense of taste enables us to appreciate the savor of substances introduced into the CHORDA TYMPANI NERVE.—mouth. Two

nerves, the chorda tympani and the glosso-pharyngeal, preside over the sense of taste. The chorda-tympani is a branch of the facial, and enters the tongue through the lingual branch of the fifth, to supply the anterior

GLOSSO-PHARYNGEAL.—two-thirds. The glosso-pharyngeal, the first division of the eighth pair, arises from the medulla oblongata, and gets out of the brain case through the foramen lacerum. It sends branches to the digastric and stylo-hyoid muscles, and is finally distributed to the tonsils, soft palate, and posterior portion of the tongue. It acts as a nerve of special and general sensibility. The organ of taste is confined

TONGUE.—to the dorsal portion of the tongue. The tongue is a symmetrical muscular organ developed on either side of a median fibrous layer which arises from the hyoid bone. It is situated in the oral cavity, and is divided into a cortex and a medullated portion. It

CIRCUMVALLATE PAPILLAE.—has at its base circumvallate papillae arranged in the form of a V.

FUNGIFORM PAPILLAE.—These are simply enlarged fungiform papillae, which are short and thick, with rounded extremities. The fungiform papillae are placed all over the tongue, being most numerous however at the tip and sides. The fungiform and circum-

vallate papillae alone are the organs of taste. The

FILLIFORM PAPILLAE.—filliform papillae are scattered over the surface between the fungiform papil-

TASTE BUDS.—lae. Taste buds are found on the circumvallate and and fungiform papillae, being flask-shaped collections of spindle-like cells, having a rounded opening called the taste pore. Sapid substances find their way into the interior of these structures, and thus come in contact with the taste cells, which are in connection with the terminal filaments of the gustatory nerve.

GENERATION.

GENERATION.—Generation is the function by which the species of a plant or animal is preserved, and its existence perpetuated.

FEMALE ORGANS.—The female organs are divided into internal and external ones. The external organs are the vulva and adjacent parts, and the vagina. The internal organs are the uterus, Fallopian

VAGINA.—tubes, and ovaries. The vagina has a curved direction, and projecting into its upper part is the neck of the uterus. It is four inches long, and its inner surface is marked by rugæ. The clitoris corres-

CLITORIS.—ponds to the penis of the male. The

UTERUS.—uterus is situated between the bladder and the rectum, being held in place by ligaments. It is pear-shaped, about three inches in length, and weighs from one and a half to two and a half ounces. It is composed of muscular structure of the involuntary

character, arranged in several layers, and is lined by

FALLOPIAN TUBES.—mucous membrane. The Fallopian tubes lead from the ovaries to the uterus, and are from three to four inches long. Their extremities near the ovary are marked by from ten to fifteen fimbriæ, which have given the name of the fimbriated extremities. All of the fringe-like extremities are free but one, and this is attached to the ovary.

OVARIES.—The ovaries are attached to the broad ligament of the uterus, and project into its posterior surface. They are of a whitish color, ovoid, and flattened in form, and are each about an inch and a half in length, and are composed of a cortical portion and a medullary portion. The cortical substance alone

GRAAFIAN FOLLICLES.—contains the Graafian follicles, being composed of connective tissue, in the

OVUM.—substance of which the ova are imbedded enclosed in sacs called the Graafian follicles. These ova cells are found iu different stages of development, and no additional ones make their appearance after birth. They enlarge, approach the surface, and are finally ruptured, discharging their contents into the fimbriated extremity of the Fallopian tubes.

VITELLINE MEMBRANE.—The ripe ovum lies

in the Graafian follicle covered by an external mem-
VITELLUS.—brane,—the vitelline membrane. Within the membrane is a granular mass, called the vitellus; a large, clear nucleus called the germinal vesicle; and a nucleolus, called the germinal spot. At the time of the rupture of the Graafian follicle, the fimbriated extremity of the Fallopian tube is applied to the ovary for the reception of the ovum, and conveys it into the uterus.

PUBERTY.—Between the ages of thirteen and fifteen years the human female arrives at puberty, and undergoes a change. Hair grows upon the mons veneris; the mammary glands develop; the Graafian follicles enlarge; the female becomes capable of im-
MENSTRUATION.—pregnation; and a periodical, sero-mucous discharge takes place from the genital organs constituting menstruation, which afterwards reoccurs monthly until it ceases at or about the age of fifty years. The interval between the flow from ending to beginning is twenty-eight days; and from beginning to ending, about five days. During pregnancy and lactation it is generally absent. Menstruation is identical with ovulation, and the blood comes from the lining membrane of the uterus.

MALE ORGANS OF GENERATION.—The penis is the organ of copulation, and passing through it is the urethra which serves to emit the product of

TESTICLES.—the testicles. The testicles are two symmetrical organs situated during intra-uterine life in the abdominal cavity, but finally descending into the scrotum, a pouch-like process of the skin. Beneath

SCROTUM.—the integument of the scrotum is a contractile tissue called the dartos. The testicles are

SPERMATIC CORD.—suspended in the scrotum by the spermatic cords, which are composed of the vas deferens, blood vessels, and nerves. The coverings of each testicle are,—the inter-columnar fascia, the cremaster muscle, the infundibuliform fascia, the tunica vaginalis, and the proper fibrous coat or tunica albuginea, beneath which is the tunica vasculosa. Each

SEMINIFEROUS TUBES.—testicle is composed of about eight hundred and forty tubes known as the seminiferous tubules, in which the male elements are

VAS DEFERENS.—formed. The vas deferens is the excretory duct of the testicle. It is nearly two feet in its entire length, joining with the seminal vescicle, forming the ejaculatory duct, which opens into the prostatic portion of the urethra. Attached to the

VESICULAE SEMINALES.—base of the bladder and situated externally to the vasa deferentia are two vesiculae seminales, composed of a coiled sacculated tube, and serving as receptacles for the seminal PROSTATE GLAND.—fluid. The prostate gland secretes a fluid which forms a part of the ejaculated semen.

SEMEN.—The seminal fluid is composed of elements from the testicle, mixed with the secretions from the vasa deferentia; from the vesiculae seminales; from the glands of the prostate; and from the glands of the urethra. It is slightly mucilaginous, of a grayish white color, does not mix with water nor contain albumem, SPERMATOZOIDS.—and in reaction is alkaline. In the semen are anatomical elements known as spermatozoids, endowed with movements like ciliated epithelium, having flattened, conoidal heads and a long, tapering, COITUS.—filamentous tail in active motion. Coitus is accomplished by the introduction of the penis into the vagina of the female. The penis of the male is made erect by turgescence of blood, and becomes sensitive especially at the glans. The introduction of the organ into the vagina, the pressure of its constrictor muscle, and friction increase the sensibility

until the venereal orgasm occurs, when the semen is discharged. Coitus in the female is accomplished by the erection of the clitoris, turgidity of the vessels of the vagina, and increase in the secretions, culminating in an orgasm similar to that of the male.

FECUNDATION.—Fecundation is accomplished by a union of the ovum of the female with the spermatozoids in the semen of the male. This molecular union between the two elements is followed by the remarkable changes of development. The vitellus of the

SEGMENTATION OF THE VITELLUS.—ovum becomes divided into numerous cells, called blastodermic cells. This process is termed segmentation of the vitellus. A membrane is soon formed over these cells known as the blastodermic membrane, which is afterwards divided into layers of cells from which the embryon comes.

AMNION.—The membrane enclosing the embryon is

ALLANTOIS.—called the amnion; that surrounding the amnion, the allantois or chorion. The fluid within

AMMIOTIC FLUID.—the amnion is termed the

UMBILICAL CORD.—amniotic fluid. The umbilical cord is the pedicle which connects the embryon with that portion of the chorion which enters into the con-

PLACENTA.—struction of the placenta. The pla-

centa is the organ by which the foetus derives its nourishment, and is composed of a maternal portion from the mucous membrane of the uterus, and a fœtal portion from the vascular part of the chorion. The FOETUS.—embryon is called the foetus at the fourth month. During gestation the uterus is enlarged but returns to normal size after delivery. The duration of pregnancy is two hundred and sixty to three hundred days. Parturition is the process by which the foetus is expelled.

SLEEP AND DEATH.

SLEEP.—One-third of our existence is passed in sleep, and in it the functions of the body are greatly modified. Sleep is more important in infancy and youth, than in adult life and old age. During sleep the brain is in a condition of absolute repose. Sleep is the result of a diminution of the supply of the blood to the brain.

DREAMS.—Dreams are automatic actions of the brain originating from impressions received from external sounds, while going to sleep or waking, or from impressions previously made upon the registering ganglia of the brain.

DEATH.—Any thing which interferes with the functional activity of the system in the processes which repair its constant waste, will result in the phenomenon called death, after which the organism decays and the products of its decomposition are appropriated by the vegetable kingdom.

TABLE OF SPECIFIC GRAVITIES.

Name.	Specific Gravity.
Sweat.	1004.
Saliva.	1005.
Gastric Juice.	1005.
Aqueous humor.	1005.
Vitreous humor.	1005.
Lymph.	1007.
Urine.	1015 to 1025.
Chyle.	1024.
Bile.	1018 to 1026.
Plasma.	1028.
Milk.	1032.
Gray nervous matter.	1034.
Brain.	1036.
White nervous matter.	1040.
Pancreatic Juice.	1040.
Colostrum.	1046 to 1060.
Blood.	1052 to 1057.
White corpuscles.	1070.
Red corpuscles.	1088 to 1105.